"EVALUATION OF SHORT TERM FUNCTIONAL OUTCOME OF PRIMARY CEMENTED TOTAL HIP REPLACEMENT IN ADULTS-A TWO YEAR PROSPECTIVE STUDY"

By

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IN

ORTHOPAEDICS

Under the guidance of

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2014

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I hereby declare that this dissertation entitled **"EVALUATION OF SHORT TERM FUNCTIONAL OUTCOME OF PRIMARY CEMENTED TOTAL HIP REPLACEMENT IN ADULTS-A TWO YEAR PROSPECTIVE STUDY"** is a bonafide and genuine research work carried out by me under the guidance of DR. KIRAN.S.PATIL, ASSOCIATE PROFESSOR OF ORTHOPAEDICS.

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Dr. MITHUN N. OSWAL

LIST OF ABBREVIATIONS USED

(In alphabetical order)

AP	ANTEROPOSTERIOR
AV	ARTERIOVENOUS
AVN	AVASCULAR NECROSIS
BP	BLOOD PRESSURE
CRP	C REACTIVE PROTEIN
DVT	DEEP VENOUS THROMBOSIS
DMP	DIMETHYL PARA
ESR	ERYTHROCYTE SEDIMENTATION RATE
IL1	INTERLEUKIN 1
IV	INTRAVENOUS
No.	NUMBER
NOF	NECK OF FEMUR
OA	OSTEOARTHRITIS
THR	TOTAL HIP REPLACEMENT
UHMWPE	ULTRA HIGH MOLECULAR WEIGHT POLYETHYLENE

ABSTRACT

BACKGROUND & OBJECTIVES

Pain in the hip joint is one of the most important causes in disabling Human locomotion. Total hip arthroplasty represents the greatest single advance in modern Orthopaedic surgery. Replacement of damaged cartilage surfaces with artificial bearing materials has enabled surgeons to improve function and relieve pain in vast majority of patients.

This study was conducted to study short term functional outcome and the complications associated with primary cemented total hip replacement in adults.

MATERIALS AND METHODS:

In our study 30 confirmed cases of hip disorders needed replacement were selected, aged between 35 years to 75years. All cases were treated by cemented Total Hip Replacement in our institution and followed up for a minimum period of 6 months to maximum of 24 months.

RESULT

All Patients were evaluated both functionally and radiologically. Functional evaluation with Harris hip score (modified) showed excellent results in 20 hips, good in 6, fair in 4 hips. No poor results were noted.

Radiological evaluations at the latest follow up of all cases showed no signs of aseptic loosening or implant failure.

INTERPRETATION & CONCLUSION

Cemented total hip replacement is a cost-effective procedure especially in elderly patients and in Indian scenario it is still has to be considered in patients less than 50 years due to financial constraints. With proper patient selection, adequate planning, and proven surgical technique, we have achieved results comparable to other authors though it is a short term study.

To conclude, in our institute, this procedure was done with utmost care and has provided us with very good clinical results. Functional results are excellent and complications were minimal. Long term studies are necessary to study the overall functional outcome over the years and complications that might occur.

KEY WORDS: Cemented; Replacement; Hip, Short term

INDEX

LIST OF TABLES

LIST OF GRAPHS

LIST OF FIGURES

INTRODUCTION

Disease/Trauma which involves the hip joint disables the individual from his day-to-day activity. Osteoarthritis of the hip is one of the oldest afflictions of mankind. No race has been exempted from the disease and the etiology of the condition has been subject of controversy and speculation[1].

Almost all patients who consult the surgeon do so because of intractable pain. Many patients also have limitation of the motion but the primary goal of operative treatment is to relieve pain[1].

Osteoarthritis and inflammatory arthritis are the most frequently encountered diseases in orthopaedics. They are the leading causes of joint disease in the hip, resulting in joint destruction, and often in the need for hip replacement[2].

Total hip arthroplasty, or surgical replacement of the hip joint with an artificial prosthesis, is a reconstructive procedure that has improved the management of those diseases of the hip joint that have responded poorly to conventional medical therapy[3].

Total hip replacement was introduced as a panacea to relieve the intractable pain of hip arthritis. Additional objectives of deformity correction and restoration of hip mobility and stability were achieved later. It has provided millions with the ability to lead a normal life [4].

Total Hip Arthroplasty represents the greatest single advance in modern orthopaedic surgery. Replacement of damaged cartilage surfaces with artificial bearing surfaces has enabled surgeon to improve function and relieve pain in vast majority of patients[1].

Currently, the most common methods of performing total hip arthroplasty utilize combinations of cemented or noncemented acetabular and femoral components[5].

Cemented Total Hip Arthroplasty (THA) is an extremely successful procedure with unsurpassed success. Recent data from multiple national joint registries show that cemented stems have superior long-term survival across all patient groups; long-term survival rates above 90 to 95% for 10 plus years can be expected[6].

The purpose of this prospective study is to evaluate the short term functional outcome of primary total hip replacement in adults conducted at BLDE HOSPITAL,BIJAPUR using modified Harris Hip Score.

AIMS AND OBJECTIVES

- Evaluation of functional outcome in primary total hip replacement in Adults using Harris Hip (Modified) score.
- To compare the study results with other established studies.

REVIEW OF LITERATURE

HISTORY

Over the last three centuries, treatment of hip arthritis has gradually evolved from osteotomy to modern total hip arthroplasty (THA), which is considered one of the most successful and most effacious surgery performed by orthopedicians ever. We here review the history of the early hip Arthroplasty procedures for hip arthritis that preceded Charley total hip arthroplasty[7].

The first surgery of the hip which had any resemblance to what is now known as arthroplasty was performed by Antony White at Westminster hospital in 1822. He excised the upper end of femur in a 9 year old boy of sepsis and dislocated hip[7].

The idea and the course to implement has slowly and painstakingly evolved over a period of about 150 years in various forms to Total Arthroplasty– *from Osteotomy,* Interposition, Reconstruction, Partial Replacement and Total Replacement.

OSTEOTOMY [7]

Rhea Barton in 1826 performed the first inter trochanteric osteotomy of femur with an ankylosed hip in a sailor of 21 years age. The result of this surgery was a pseudoarthrosis, which provided a reasonable range of movement and comparative stability. Barton provided the first evidence that motion would prevent the fusion of bone.

This popularized hip osteotomy as a rational plan for overcoming bony ankylosis, a hitherto untreated lesion.

INTERPOSITIONING[7,8]

Auguste Stanislas Verneuil (1823–95), from Paris, France, performed soft tissue hip interpositions in 1860 of Muscle, Fat and Fascia interpositions. Subsequently, Czech surgeon Vitezlav Chlumsky (1867-1943), working in Breslau, Germany (now Wroclaw, Poland) systematically experimented with many interpositional materials. Among the wide variety of materials he used was muscle, celluloid, silver plates, rubber struts, magnesium (which had the detestable characteristic of fomenting exactly the opposite of what it was supposed to do, this being consolidation of bone osteotomies or fractures), zinc, glass, pyres, decalcified bones, wax and celluloid[7.]

Earlier in the 1900s, Murphy, along with Erich Lexer (1867-1937) from München, Germany, had advocated the hip interposition of *fascia lata*. This was a modification of the technique described in 1893 by another German surgeon, Heinrich Helferich (1851- 1945), who worked in Tübingen and performed a similar procedure for the treatment of temporomandibular joint arthritis.

In 1902 Sir Robert Jones (1855- 1933) used a strip of gold foil to cover reconstructed femoral heads. Twenty-one years later, he was able to report that the patient still retained effective motion at the joint.This was the longest follow-up report recorded, to that point, in the history of arthroplasty. Baer in 1918 used chromicised submucosa of a pig's bladder that became known as Baer's membrane

RECONSTRUCTION AND PARTIAL REPLACEMENT[7,8]

The era of reconstructive procedures began with Brackett in 1917 who performed A procedure placing the upper end of the femur into the hollowed out femoral head. Over a period of five years these reconstructive procedures were found to give poor results and hence fell into disrepute.

It was the Norwegian-born American surgeon Marius Smith-Petersen (1886-1953) from Boston, Massachusetts who in 1923 provided synthetic interpositional arthroplasty with a mold prosthesis. This arthroplasty was intended to facilitate bone-implant movement both at the femoral and the acetabular sides of the implant[8].

In 1924, Royal Whitman (1857-1946), from The Hospital for Ruptured and Crippled (now The Hospital for Special Surgery) in New York City, published the first description of hip osteoarthritis surgery by means other than fusion. Following this, several modifications of the procedure were attempted with variable, but not definitive success, as it was necessary to sacrifice either mobility or stability of the joint in order to achieve remission of pain[8].

Bohlmann and Moores in America, in 1940, used a stainless steel metal prosthesis and this was a major step forward for future developments.

However, a lot of attention for early prostheses was garnered by the Judet brothers—Robert (1901-80) and Jean (1905-95), from Paris, France. They used an acrylic prosthesis in 1948. The Judet prostheses turned out to be exceptionally susceptible to wear, and failed even before the general acclaim had ceased. In 1950, this prosthesis failed due to disintegration of the acrylic material leading to loosening and foreign body reaction.

The Judet brothers concept was refined by Frederick Röeck Thompson, (1907-83) who developed a Vitallium prosthesis in 1950 which featured a distinctive flared collar below the head and a vertical intramedullary stem, by Harold R. Böhlman (1893-1979) from Nebraska, and Austin Moore (1899-1963). Dr. Moore inserted the first such metal prosthesis at John Hopkins Hospital in 1940.

In the same year, Thompson and Moore in 1952described their long stemmed metal prosthesis. However, it was the erosion of the pelvis side that brought attention to the need for resurfacing of the acetabulum.

In 1972, CJE Monk of Liverpool, described a prosthesis with an in built acetabular component. This combined the simplicity of the partial joint replacement with the advantages of total hip replacement. It was used for many years with gratifying results.

TOTAL REPLACEMENT[09,10]

Mckee and Watson Farrar (1951) introduced a stainless steel prosthesis. Acetabular component was fixed with screws. Subsequent to the failure, they modified their device using cobalt-chromium alloy and fixed with self-curing acrylic cement.

All metal combinations were introduced by **McKee and Farrar** (1966) and **Ring** (1968) in England and by **Haboush, Urist and McBride** in US (1957).[09,11,12] However, the stage was set for **Sir John Charnley** to drive the evolution of a truly successful operation in orthopaedics, modern Total Hip Arthroplasty.

Sir John Charnley first reported his clinical experience with a steel femoral component and an acetabular component lined with teflon. **Charnley** in 1962 introduced high molecular weight polyethylene for sockets in hip arthroplasty. **Charnley** in 1965 described fixation of the components with methylmethacrylate.

It was **John Charnley** (1970) who led the way in establishing THR as a useful procedure. His important breakthrough was his concept of low friction arthroplasty.[13]Previously all surgeons had substituted prosthesis that was the same size and configuration as normal human anatomy, Charnley reduced the diameter of the head on the femoral stem to 22mm to improve the frictional torque. **Muller** followed suit by introducing a design with a femoral head diameter of 32mm. After an initial failure with the use of Poly tetra – flouro ethylene (Teflon) as a bearing surface, Charnley adopted high molecular weight polyethylene, which was satisfactory. He also adapted PMMA (Polymethyl Methacrylate) cement on the suggestion of **Leon Willsie** of Los Angeles (1960).[10]

Miller introduced Low viscosity cement[14] in 1982 and **Robert Ling** pointed the importance of careful preparation of bone surfaces and of forcing the cement into bone by pressure.[15]

William Harris (1983) studied and populated the use of improved cementing techniques.[16,17] In a reaction to problem incident to the use of the acrylic cement, efforts were made to promote a more biological fixation by elimination the cement altogether and providing a stem with a porous surface allowing for bone in growth . **Pillar and Galante's** (1983) research groups were pioneers in the approach[18,19]. The introduction of femoral components made of titanium also allowed fixation without the use of bone cement and without porous coating.

The indications for total hip replacement have evolved since the introduction of the procedure. Total hip replacement is indicated in patents exhibiting hip joint deterioration from a number of causes including degenerative arthritis, rheumatoid arthritis ankylosing spondylitis, primary and secondary avascular necrosis, post surgical ankylosis, benign and malignant bone tumours around the hip joint fractures.

In the decade of the seventies, age was an overwhelming consideration. Because of the uncertainty surrounding long term efficacy of the procedure, and the potential of late failure, only the elderly were considered reasonable candidates. The procedure was thought to be contraindicated in young patients, particularly those below the fourth and fifth decade of life. As data on long term survivorship has become available, age limits have been extended total hip replacement can be considered given the appropriate indication, in any age groups after skeletal maturity. However, this procedure cannot be successfully used in the young and active individuals without a change in activity levels leading to a more sedentary life style. Manual labor, heavy lifting, high intensity sport activities are all capable to lead to premature failure. Fixation of prosthetic components was considered the main factor in success and also the most likely mechanism of failure. The mechanism of loosening can be seen as secondary to mechanical or biological factors as described by **Schmalzried T.P** et al in 1992.[20,21]

From the mechanical view point, the repetitive nature of the external loads generates stresses at the prosthesis and the interface that may eventually lead to failure of the cement and its bonds to the prosthetic device and to bone. In case of cementless stems, mechanical failure can occur if the areas available for osseointegration and ingrowths are limited by design, or if the extent of ingrowth was small to begin with. The biological mechanism involves degradation of the cement bone or of the cementless interface resulting from the migration of wear particles. These particles may originate from wear of the polyethylene at the joint articular surface, from corrosion products generated at the **Morse** taper cone junction of the femoral head, and from abraded cement or metal debris from the implant. These particles have been clearly linked to a granulomatous reaction leading to membrane formation, osteolysis and eventual implant loosening. In practice, although both mechanical and biological effects operate in the loosening process, the determining factor may be one or other, depending on a number of circumstances including implant design, fixation mode, and technique, as well as biological factors unique to the individual. Fixation is best studied under two separate headings, cement and cementless.

Long term survival of the cemented femoral components has improved with improvement in cementing techniques.[16,22,23,24,25] Statistically significant greater incidence of cement bone radiolucencies were found in failed groups indicative of incomplete cement filling.[26] Several studies have suggested that various orientation of the femoral stem has been associated with a higher percentage of aseptic loosening.[27,28,29.30,] Varus positioning of the results in a thin or nonexistent cement mantle in the proximal medial and distal lateral zones. Stem loosening correlated with varus position in 50% and inadequate cement filling mantle in 34% of patients in **Callaghan's** series(1985).[31] **E Ebramzadeh** et al (1994) identified increased loosening in stems placed in more 5 degree of varus.[29] This importance of techniques has been recognized as foremost in failure or success of arthroplasty.

Cementing techniques have evolved over last several decades to the current status.

First generation

Cementing techniques refers to fingers pushing doughy cement into the unplugged femur canal . The femoral components often had sharp corners with a narrow medial border and were made of stainless steel. Most often it resulted in complete cement mantle.

Second generation

Cementing techniques involved plugging the medullary canal, cleaning canal with pulsating lavage, and inserting the cement in a retrograde fashion using a cement gun. The implants of this generation were made of super alloys. Implant designs were modified to remove sharp corner, and to have a broad medial border.

Third generation

Cementing techniques included all second generation techniques plus porosity reduction of the cement, pressurization of the cement mantle and surface modifications on the implants, which includes micro and macro texturing as well as industrial application of polymethyl methacrylate (PMMA) to the implant to improve the bond between the implant and the cement.

Fourth generation

Techniques refer to all the elements of third generation techniques plus stem centralization proximally and distally to ensure adequate and symmetric cement mantles.

Mechanical factors appear responsible for loosening in most cases of cemented femoral stem. Debonding between the stem and cement occurs at the cement metal interface.[31,32] Out of phase forces involved with stair climbing products peak stresses in the cement mantle proximally and near the distal tip of the stem. These stresses are high enough to initiate cement cracks. Cracks are more prone to form in areas of thin cement or adjacent to cement mantle defects. In addition, pores in the cement have been found to be sites for crack initiation and propagation . Once these mechanical events have occurred, biological process steps in. As a result of debonding and cement fracture, stability of the stem is compromised and particulate polymeric debris can gain assesses to the endosteal bone. Debris stimulates foreign body reaction, which causes bone resorption and results in the fibrous tissue membrane.[33,34] This eventually leads to loosening of the implant.[35,36]

Historical studies have demonstrated a classic foreign body granuloma abundance of macro phages.[37,38,39,40] Particulate debris whether PMMA, polyethylene, titanium or cobalt, is thought to initiate the osteolytic process (1994). Assess of particulate debris to the periprosthetic interface was essential for the imitation of osteolysis.[40] It is also seen that cement third generation techniques help provide protection against the femoral osteolysis by limiting assess of particulate polyethylene to the cement bone interface. Fragmentation of the cement has been identified as a source of PMMA particles and focal osteolysis.[40] Cell culture studies have shown that particulate (PMMA) stimulates release of a variety of bone resorbing factors including IL1, TNF and PGE2, from mono nuclear cells.[41]

Skeletal remodelling has also been postulated to be a cause of aseptic loosening in the cemented femoral stems.[42] In a normal lower extremity , load is transmitted from the femoral head of the cortical bone of the proximal femur. This is markedly altered in THR. The implant and bone now share load normally carried by proximal femur alone.[35,43] In vitro studies have shown that the strain measured in the proximal femur medial cortex (the calcar region) after insertion of a femur component is only 15% of that measured in the intact femur prior to implantation.[43] Adaptive remodelling theory predicts that the reduction in strain and strain results in resorptive remodeling.[43] Radiographically this phenomenon is visible as osteopenia in the calcar region and is refer to as **Stress Shielding** . In addition, normal age related changes lead of widening of canals, thinning of cortical bones and increase porosity with advancing age. Thus it has been suggested that with ageing, cortex will grow away from the cement and lead to loosening.[44] However this hypothesis has not been well supported on autopsy studies.[40, 45, 46]

Long term survival of the cemented femur components has improved with improvements in cementing techniques. Several studies have demonstrated better results with second compared to first generation techniques.[47] In a study by **Russotti G M** et al in 1988 of 251 patients followed for 5 yrs , patients who had a **Harris**

Design II femur stem inserted with the use of an intramedullary plug, pulsating lavage and a cement gun, achieved a 98% excellent result.[48]

High success rates with third and fourth generations cement are appearing in early outcome studies. **Oishi et al**[49] reported on 100 consecutive patient's using third generation cements techniques for an average of 6-8 years. Eighty nine patients survived and the rate of mechanical failure was only 1%. Modern cementing techniques have also led to improvements in long termresults for cemented femoral stems in young patients.[50,51,52]

In contrast to the excellent long term results seen with cemented femoral stems, the long term results of cemented acetabular components have not had similar success. Loosening rates of 7 to 40% have been reported at 10 years follow up even with the use of modern cementing techniques.[53,54] Technically it is more difficult to obtain suitable conditions for cementing in the acetabulum. Also the nature of the articular trabecular bone allows easier progression of reactive membrane at the cement bone interface.

Mulroy and **Harris** reported on 105 hips using modern cement techniques at an average of 11 years follow ups, noting socket revision or global radiolucency in 44% of cases.[53] Older reported on series of 153 **Charnley** prosthesis followed for 11 years, and reported a failure rate of 11.1%.[55]

A clinical and roentgenographic study was done on 52 primary total hip arthroplasties by **Davey** and **Harris**[56] between 1982-84. The average follow up was for 31 months and the average age of the patients was 55 years. The initial diagnosis was osteoarthritis in 21 hips, CDH in 11 hips, avascular necrosis in 8 hips and rheumatoid arthritis in 7 hips. 2 Hips had slipped capital femoral epiphysis, one, Legg Perthes disease, one Paget's disease and one, prior poliomyelitis. 50 hips were classified as good or excellent, one as fair and one as a poor result. No total hips components required revision. No acetabularm component had migrated and only one hip showed progressive radiolucencies around acetabular component. No femoral component was rated as definitely loose or probably loose, and only one was rated possibly loose. Preoperative mean Harris hip score of 46 points improved to 92 points. Post operatively with 96% hips rating good to excellent results. Postoperative pain was none or slight in 49 hips and mild pain in other 3 patients. No patient complained of mid thigh pain. Thirty-one patients (35 hips) walked without a limp and 12 patients (12hips) walked with a slight limp. Five patients (5 hips) had a moderate limp. Overall incidence of heterotypic bone was 43% (22 hips) complication from surgery included eight cases of deep vein thrombosis, one sciatic nerve and two peroneal nerve palsies and four post operative dislocations.

Wixon, Stulburg and **Mehlhoff**[56] performed a comparison of clinical and radiographic results with cemented, uncemented and hybrid prosthesis performed on 144 hips in 1991 . The overall clinical results were similar for the three groups . For the 52 hips that have cemented prosthesis, the mean total Harris hip rating was 91 points and the score for pain. 42 points, for 27 patients that had a hybrid prosthesis, 90 and 43 points and for the sixty five hips that had an implant allowing in growth of bone in both acetabulum and femur, 95 and 43 points. The higher mean Harris hip score in uncemented prosthesis was attributed to younger age of patients and lower number of patients who had another concomitant cause of disability. Two uncemented stems had aseptic loosening, one was revised. Pain in the thigh occurred in 24% of uncemented stems at one year, the prevalence of pain then declined. The incidences of migration of the components and of radiolucent lines were greater in the acetabulum that had a cemented component that in those that had cup allowing in growth of bone.

Callaghan JJ [57]**et** al in an exceedingly long term follow up of at least 25 years in old individuals of average age of 65 years using Charnley total hip arthroplasty with cement found 5 percent had the revision because of loosening with infection; 18 percent because of aseptic loosening and 77 percent had retained the original prosthesis. They concluded the durability of the procedure as a standard against which subsequent procedures can be evaluated.

RC Siwach,[58]**et al** conducted a retrospective study of 100 cases operated with total hip arthroplasty using modular prosthesis in patients in age group 35 to 70 years with a variety of causes of degenerative arthritis like idiopathic avascular necrosis, rheumatoid arthritis, ankylosing spondylitis, primary osteoarthritis and posttraumatic secondary osteoarthritis. With a mean follow up of 6.02 years they found at the last follow-up mean Harris Hip score was 83.5. Radiolucent lines were present in 39% acetabular and 32% femoral components. Eight hips were revised, five for aseptic loosening and three hips for posttraumatic periprosthetic femoral fracture. One girdle stone resection was done for deep infection. Out of 96 hips available at latest follow-up, 87 primary arthroplasties were intact and functioning. The authors concluded that clinical results were excellent and comparable with clinical results in international studies**.**

Rajendra Nath[59]***et al*** conducted a study on 30 patients treated with primary total hip arthroplasty and followed up the patients for a period of 10 years. They concluded that the Harris Hip Score showed significant improvement after Primary THR Post-operatively compared to Pre-op Score in both early and late follow-ups with the maximal improvement seen in patients with Osteoarthritis and AVN of femoral head.

Colin Hopley,Dirk Stengel, Axel Ekkernkamp,Michael Wich[60] et al conducted a study to determine whether total hip arthroplasty is associated with lower reoperation rates, mortality, and complications, and better function and quality of life than hemiarthroplasty for displaced fractures of the femoral neck in older patients. Concluded that Single stage total hip arthroplasty may lead to lower reoperation rates and better functional outcomes compared with hemiarthroplasty in older patients with displaced femoral neck fractures.

ANATOMY [61, 62]

The Hip joint is a Multi-axial joint of Ball and Socket (Spherodial, Cotyloid) type. The femoral head articulates with the cup-shaped (cotyloid) acetabulum. Acetabulum is an approximately hemispherical cavity central on the lateral aspect of the innominate bone. It faces antero-inferiorly. It is surrounded by an irregular margin deficient inferiorly at the acetabular notch. The acetabular notch is filled by the transverse ligament, completing the concavity of the articular surface. The acetabular fossa is in the cavity's central floor, which is rough and non-articular. The articular lunate surface is widest above where the weight is transmitted to the femur.

Beyond the articular margin, the rim of the acetabulum gives attachment to the fibrocartilaginous acetabular labrum. This labrum encloses the femoral head beyond its equator, thus increasing the stability of the joint. The central non-articular part of the acetabulum is occupied by fat pad.

The head of the femur is capped with hyaline cartilage and is more than half a sphere. Its medial convexity has a pit, "The Fovea" for the ligament of the head. The neck of the femur is about 5 cm long and connects the head to the shaft at an angle of about 125 degrees (Angle of Inclination, Range l20 – 140 degrees). The neck is also laterally rotated with respect to the shaft at about 10-15 degrees (Angle of Anteversion). The angle of inclination is strengthened internally by calcar femorale.

The neck's anterior surface is flat and marked at the junction with the shaft by a rough intertrochanteric line. The posterior surface facing back and up, is transversely convex,and concave in its long axis. Its junction with the shaft is marked by the rounded intertrochanteric crest.

Greater trochanter is a larger and quadrangular projection up from the junction of the neck and shaft. Its postero-superior region projects supero-medially to overhang the adjacent posterior surface of the neck and here its medial surface presents the rough trochanteric fossa.

Lesser trochanter is conical postero-medial projection of shaft at the posteroinferior aspect of its junction with the neck. Its summit and anterior surface are rough, but the posterior surface, at the distal end of the intertrochanteric crest is smooth. It is not palpable.

The shaft is narrowest centrally expands a little upwards, but more so towards its distal end. Its long axis makes an angle of about 70 degrees with the vertical and diverges about l0 degrees from the long axis of tibia.

The joint capsule is strong and dense. It is attached above to the acetabular margin 5-6mm beyond its labrum, in front to the labral aspect, and near the acetabular notch to its transverse acetabular ligament and the adjacent rim of the obturator foramen. It surrounds the femoral neck and is attached in front to the intertrochanteric line, above to the base of the femoral neck, behind about 1 cm, above the intertrochanteric crest, below to the femoral neck near the lesser trochanter.

The capsule is thicker anterosuperiorly where maximal stress occurs, particularly in standing, whereas postero-inferiorly it is thin and loose1y attached. It has two sets of fibres, circular and longitudinal. The circular fibres, Zona Orbicularis are internal forming a collar around the neck. Externally, longitudinal fibres are numerous in the anterosuperior region.

Synovial membrane starts from the femoral articular margin, covers the intracapsular part of neck and passes to the capsule's internal surface to cover the acetabular labrum, ligament of head and fat in acetabular fossa.

The capsule is strengthened by three ligaments

(i) The Iliofemoral

(ii) Ischiofemoral

(iii) Pubofemoral ligament.

Iliofemoral ligament is triangular and very strong. It is anterior and intimately blended with capsule. Its apex is attached between anterior inferior iliac spine and acetabular rim; its base to the intertrochanteric line. It is often referred to as the Y shaped ligament of Bigelow.

Pubofemoral is also triangular, has a base attached to the iliopubic eminence, superior pubic ramus, obturator crest and membrane. The Ischiofemoral ligament thickens at the back of the capsule.

The Ligamentum teres (of the head of the femur) is a triangular band, its apex attached anterosuperiorly in the pit on the femoral head. Base is attached on both sides of the acetabular notch, between which it blends with the transverse ligament.

Relations[61]

The joint capsule is surrounded by muscles.

ANTERIORLY, the iliac bursa lies over the capsule and extends upward into the iliac fossa beneath the iliacus. The psoas major tendon separates the capsule from the femoral artery and iliacus separates it from the femoral nerve, while more medially pectineus intervenes between the capsule and femoral vein. Iliacus and psoas major are assisted by pectineus to act as hip flexors.

SUPERIORLY, the reflected head of the rectus femoris contacts the capsule medially while gluteus minimus covers it laterally, being closely adherent. The gluteus medius and minimus help in abduction and internal rotation.

INFERIORLY, lateral fibres of pectineus adjoin the capsule and more posteriorly obturator externus spirals obliquely to its posterior aspect.

POSTERIORLY, the lower capsule is covered by the tendon of obturator externus, separating it from quadratus femoris and accompanied by an ascending branch of the medial circumflex femoral artery. Above this, the tendon of obturator internus and the gemelli contact the joint, separating it from the sciatic nerve. The nerve to quadrates femoris is deep to the obturator internus tendon.

Obturator muscles, gemelli and quadratus help in lateral rotation. Extension is by gluteus maximus and hamstrings while adduction is by adductor longus, brevis and magnus assisted by pectineus and gracilis.

Articular arteries are branches from the obturator, medial circumflex, superior and inferior gluteal arteries. Nerves are from the femoral or its muscular branches, the obturator, accessory obturator, nerve to quadratus femoris and superior gluteal nerve.

Arterial Supply

The arterial supply of the proximal end of femur has been studied extensively. The description by Crock seems to be the most appropriate because it is based on three plane analysis and provides a standardization of anatomic nomenclature.

Crock described the arteries of the proximal femur in three groups: [63(98)]

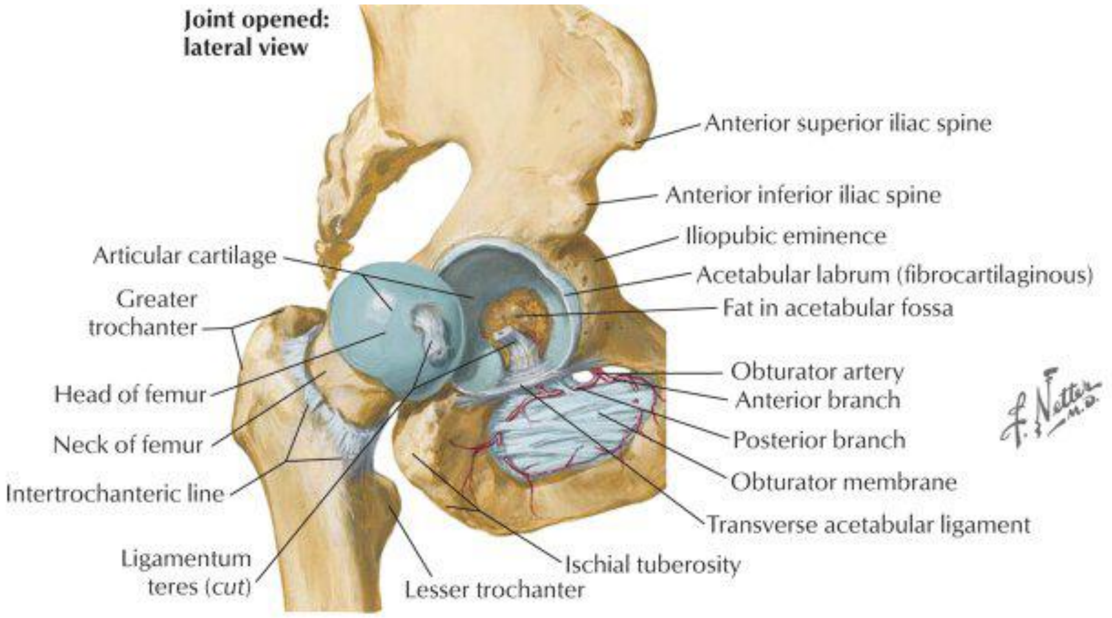
1. An extracapsular arterial ring located at the base of the femoral neck.
2. Ascending cervical branches of the extracapsular arterial ring on the surface of the femoral neck.
3. The arteries of the round ligament.

The **Extracapsular Arterial Ring** is formed posteriorly by a large branch of Medial Circumflex Femoral Artery and anteriorly by the Lateral Circumflex Femoral Artery, both arising from the profunda femoris artery, a branch of the femoral artery. The superior and inferior gluteal arteries also have minor contributions to the ring.

The **Ascending Cervical Branches** arise from the extracapsular arterial ring

The **Artery of Ligamentum Teres or Foveal Artery** is a branch of the obturator artery and supplies a small portion of the head.

Figure 1: ANATOMY OF THE HIP JOINT



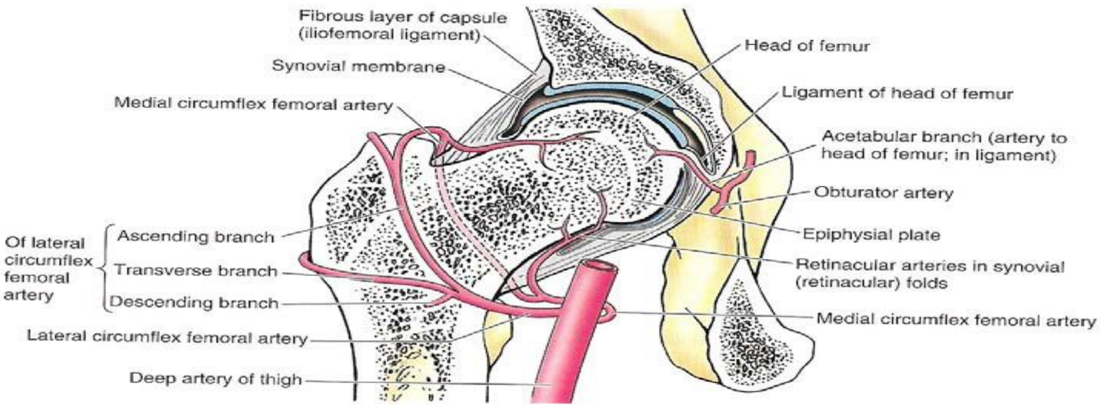
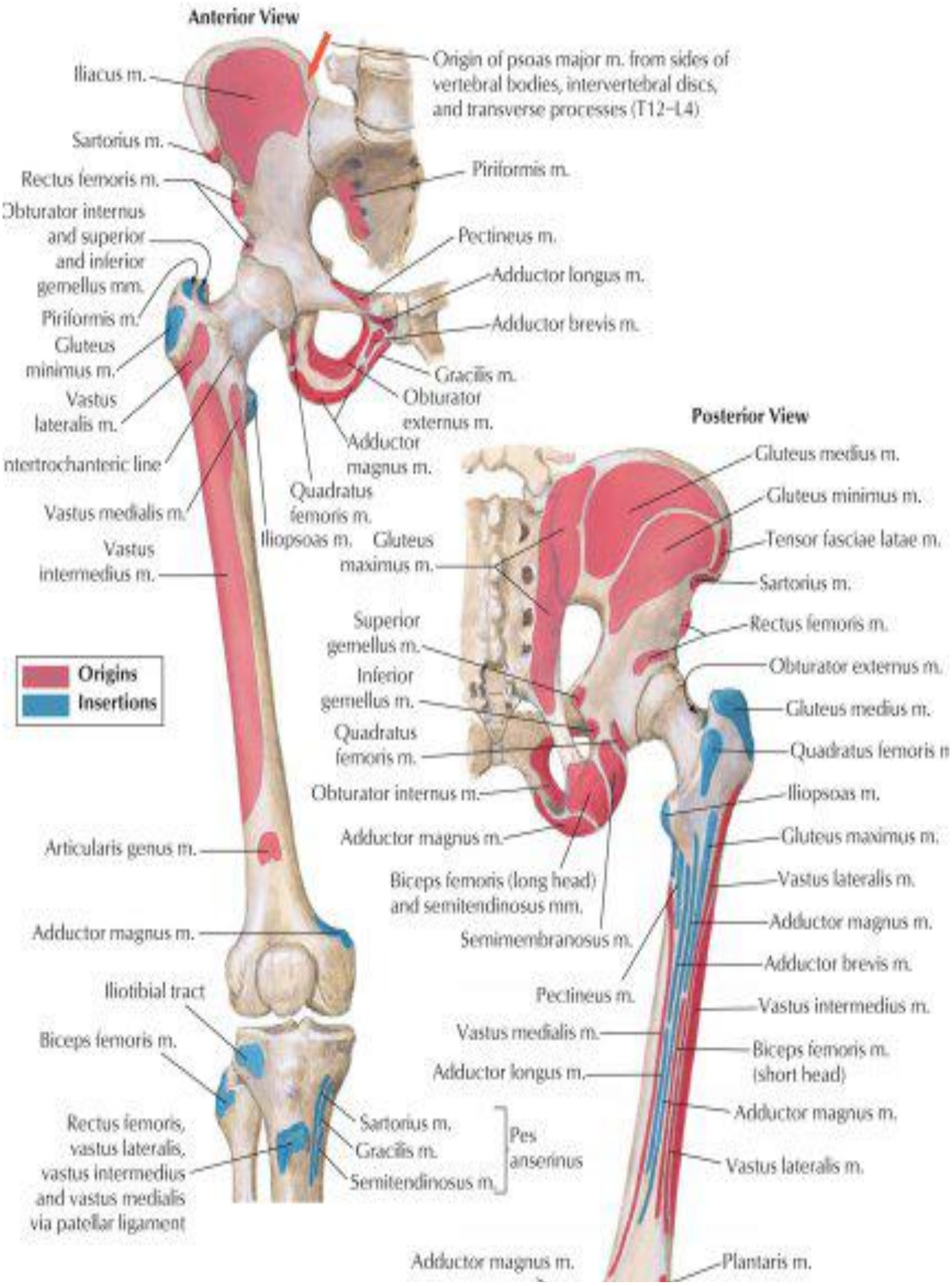


Figure 2: Arterial Supply of Hip Joint

Figure 3: Anterior and Posterior View of Hip



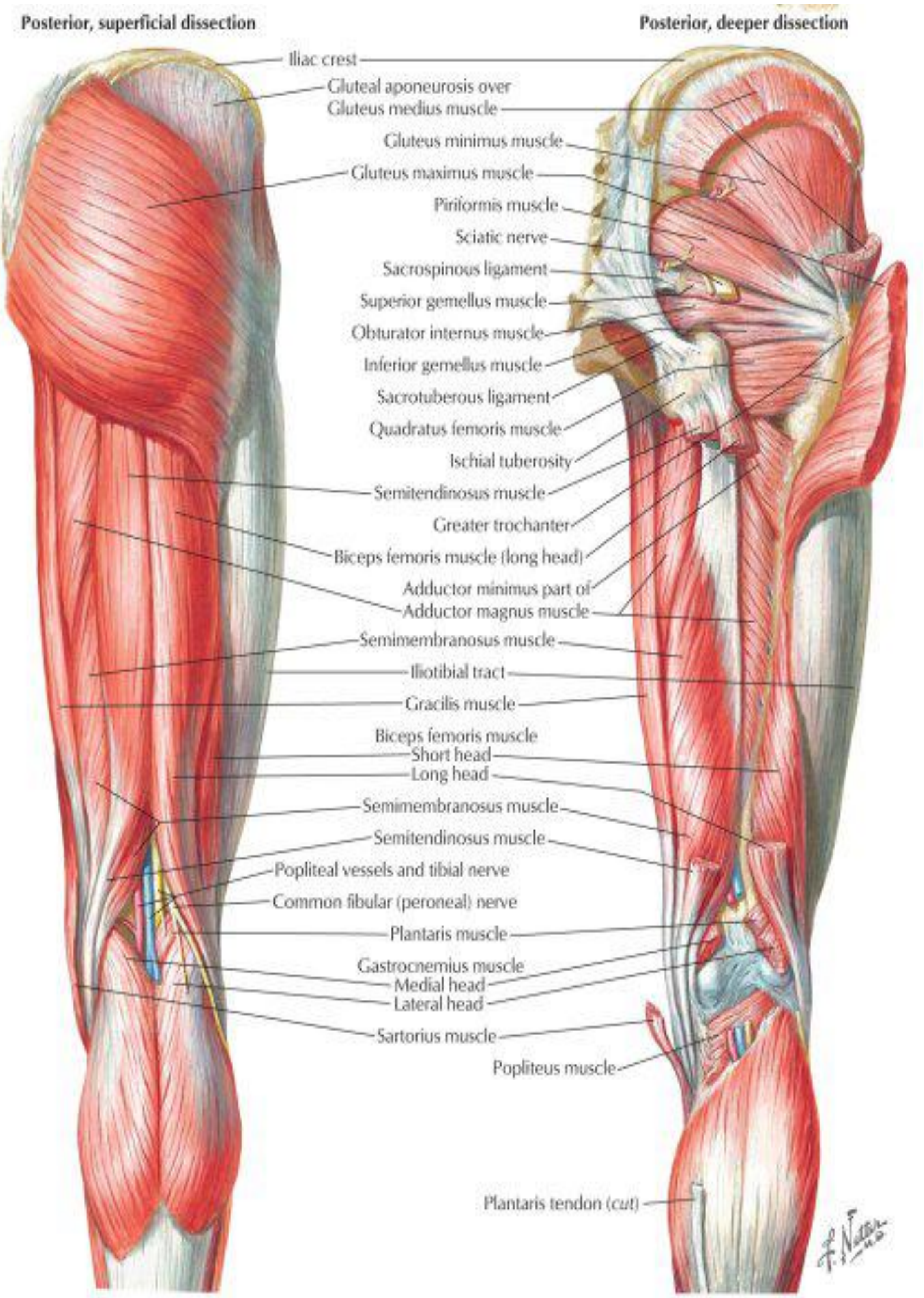


Figure 4: Posterior dissection of hip

BIOMECHANICS[13,63,64,65,66]

The hip joint functions on the bio-engineering principle of moment of force with a fulcrum, lever arm, power arm. Total hip components must withstand many years of cyclic loading equal to at least three to five times the body weight, and at times they can be subjected to overloads of 10 to 12 times the body weight. A basic knowledge of the biomechanics of the hip and of total hip arthroplasty is necessary to perform the procedure properly, to manage the problems that may arise during and after surgery successfully, to select the components intelligently, and to counsel patients concerning their physical activities.

Forces Acting on the Hip[63,64]

To describe the force acting on the hip joint, the body weight can be depicted as a load applied to a lever arm extending from the body's center of gravity to the center of the femoral head. The abductor musculature, acting on a lever arm extending from the lateral aspect of greater trochanter to the center of the femoral head, must exert an equal moment to hold the pelvis level when in a one-legged stance, and a greater moment to tilt the pelvis to the same side when walking or running. Since the ratio of the length of lever arm of the body weight to that of abductor musculature is about 2.5: 1, the force of abductor muscles must approximate 2.5 times the body weight to maintain the pelvis level when standing on one leg. The estimated load on the femoral head in the stance phase of gait is equal to the sum of forces created by the abductors and the body weight and is at least 3 times the body weight; the load on the head during straight leg raising is estimated to be about the same..The loading pattern of upper end of femur during physiological activity is cyclical and can never be reproduced accurately in an experimental set up.[63]

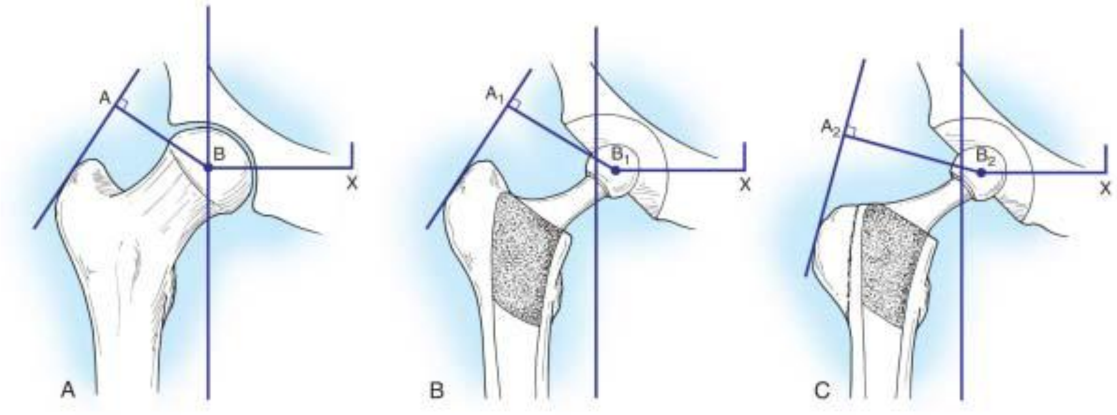


Figure 5 : LEVER ARMS ACTING ON HIP JOINT.

A. MOMENT PRODUCED BY BODY WEIGHT APPLIED AT BODY'S CENTER OF GRAVITY, X, ACTING ON LEVER ARM, B-X, MUST BE COUNTERBALANCED BY MOMENT PRODUCED BY ABDUCTORS, A, ACTING ON SHORTER LEVER ARM, A-B. LEVER ARM A-B MAY BE SHORTER THAN NORMAL IN ARTHRITIC HIP.

B. MEDIALIZATION OF ACETABULUM SHORTENS LEVER ARM B-X, AND USE OF HIGH OFFSET NECK LENGTHENS LEVER ARM A-B.

C. LATERAL AND DISTAL REATTACHMENT OF OSTEOTOMIZED GREATER TROCHANTER LENGTHENS LEVER ARM A-B FURTHER AND TIGHTENS ABDUCTOR MUSCULATURE.

Variations in the local morphology[63,64]

Muscle mass, limb position and other momentary influences, continually alter the resultant stresses on the femoral neck. Static femoral loading is of the cantilever type, with compressive stresses on the medial side and tensile stresses on the lateral side.

During routine one legged stance with femur underneath the body, there are only compressive stresses, very high along the medial cortex and calcar, and minimal along the superior cortex. In non physiological loading, like during abduction there are high compressive forces along the medial cortex with moderate to high tensile forces along the superolateral cortex. Resultant is a high bending stress leading to fracture in varus.

After the break the same would continue as shear force and cause displacement. In a single leg stance the superincumbent body weight W acts at an angle of 15° to the vertical, in the coronal plane. The resultant force can also be resolved into two components.

Shear component = Fs = F shear acting at right angles to the neck.

The axial component = Fa = F axial acting along the neck.

For any given hip, the forces can be represented mathematically,

$$F\ shear = W \times \sin(180 - (X - 15))$$

Where W = Superincumbent body weight

X = Neck shaft angle

$$F = Axial = W \times \cos(180 - (X + 15))$$

Frankle's studies have shown that the final resultant force direction on the neck would change the fracture into various morphological groups. The high ratios of F axial to F shear would cause sub capital fracture. Lesser values of F axial to F shear ratio cause high cervical, more vertical fractures.

In vivo, the total force quantum would depend upon gravitational force, muscle force, and also force of impact against the ground. Some people consider rotational stresses responsible for femoral neck fractures. However, **Backman's** experience disproved alleged role of rotation. Due to very low friction between the acetabulum and head, it was impossible for him to cause fracture by rotational stresses.

APPLIED BIOMECHANICS

The biomechanics of total hip replacement are different from those of the screws, plates and nails used in bone fixation because these latter implants provjde only partial support and only until the bone unites. Total hip components mustwithstand many years of cyclic loading equal to at least 3 to 5 times the body weight, and at times they can be subjected to overloads of as much as 10 to 12 times the body weight[63].

Forces acting on prosthesis[64]

The forces on the joint act not only in the coronal plane, but because the body's center of gravity (In the midline anterior to the second sacral vertebral body) is posterior to the axis of the joint they also act in sagittal plane to bend the stem posteriorly. The forces acting in this direction are increased when the loaded hip is flexed, as when arising from a chair, ascending and descending stairs or an incline, or lifting. During the gait cycle, forces are directed against the prosthetic femoral head from a polar angle between 15 and 25 degrees anterior to the sagittal plane of theprosthesis. During climbing and straight leg raising, the resultant force is applied at a point even farther anterior on the head. Such forces cause posterior deflection or retroversion of the femoral component.

Rotational stability of the stem can be increased both proximally and distally. Increasing the width of the proximal portion of the stem to better fill the metaphysic increases the torsional stability of the femoral component, especially when it is implanted without cement. A rounded, rectangular cross section of distal portion of stem resists rotation within a cement mantle better than a circular one.

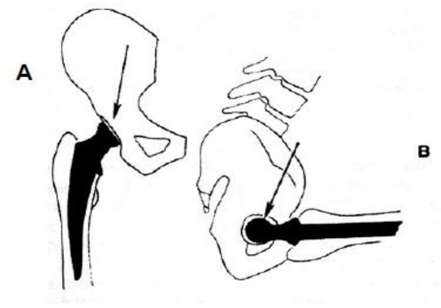


Figure 6: Forces producing torsion of the stem. Forces acting on the hip in coronal plane (A) tend to deflect the stem medially, and forces acting in the sagittal plane (B), especially with hip flexed or when lifting, tend to deflect the stem posteriorly. Combined they produce a torsion of the stem.

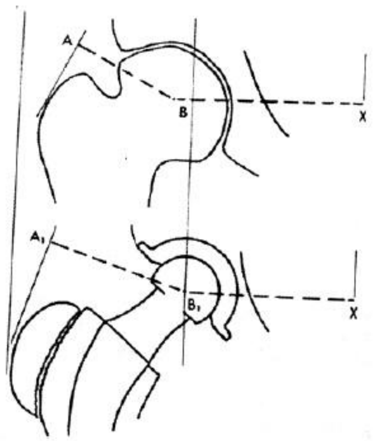
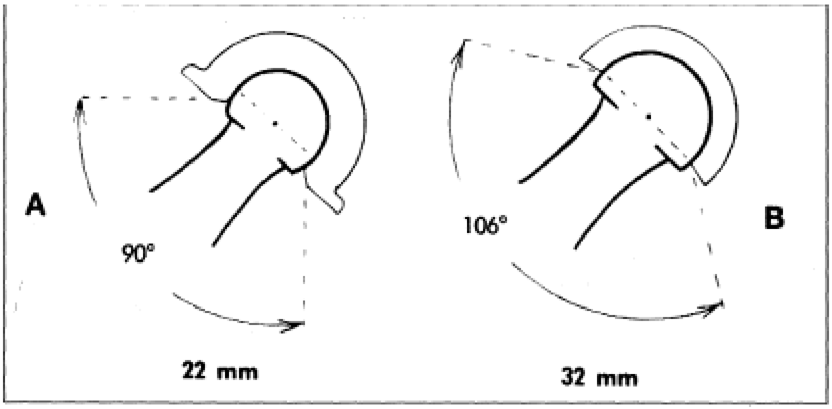
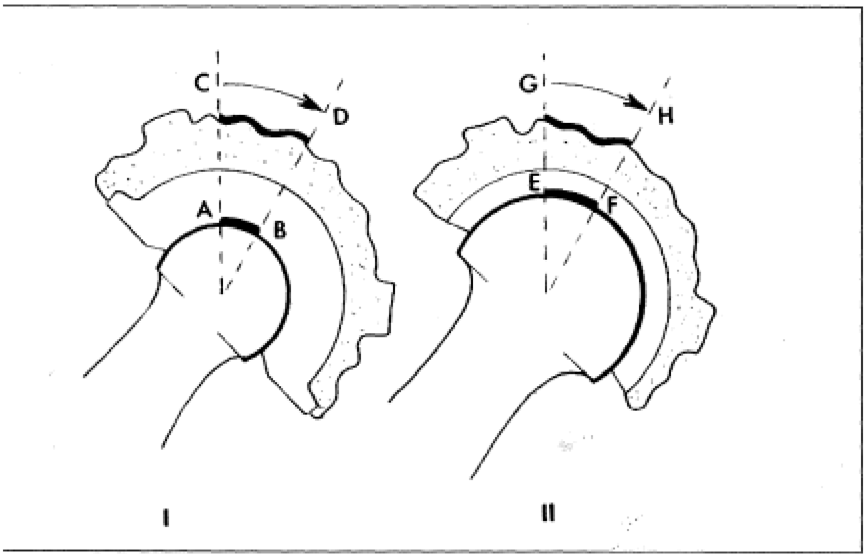


Figure 7: Lever arms acting on hip joint. Moment produced by body weight applied at body’s center of gravity X, acting on the lever arm B-X, must be counterbalanced by the moment of the adducters A, acting on the short lever arm A-B. Lever arm A-B may be shorter than normal in arthritic hip. Centralization of the head shortens the arm B-X, and lateral reattachment of trochanter lengthens the arm A-B.



ARCS OF MOTION WITH SMALL AND LARGE HEADS AND CUPS



FRICTIONAL TORQUE FORCES ON IMPLANTS

Figure 8

Centralisation of Head and Lengthening of Abductor Lever Arm [13,64,66]

An integral part of the Charnley concept of total hip replacement was to shorten the lever arm of the body weight by deepening the acetabulum (centralization of femoral head) and to lengthen the lever arm of the abductor mechanism by reattaching the osteotomised greater trochanter laterally. Thus the moment produced by the body weight is decreased and counterbalancing force that the abductor mechanism must exert also is decreased.

The lateral rather than distal reattachment of the greater trochanter must be appreciated because it may lengthen the lever arm of abductors significantly.

In an arthritic hip the ratio of the lever arm of the body weight to that of the abductors may be as high as 4:1. The lengths of the two lever arms can be surgically changed to make their ratio approach 1:1; theoretically this reduces the total load on the hip by as much as 30%.

It is important to understand the benefits derived from centralizing the head and lengthening the abductor lever arm; however, neither technique is currently emphasized. The principle of centralization has given way to preserving as much subchondral bone in the pelvis as possible and to deepening the acetabulum only as much as necessary to obtain bony coverage for the cup.

Because most of the total hip procedures are now done without osteotomy of the trochanter, the abductor lever arm is altered only relative to the offset of the head to the stem.

Neck Length and Offsets[67,68]

The ideal femoral reconstruction reproduces the normal center of rotation of the femoral head. This location is determined by three factors

1. Vertical height (vertical offset)
2. Medial offset (horizontal offset or simply offset) and
3. Version of femoral neck (anterior offset)

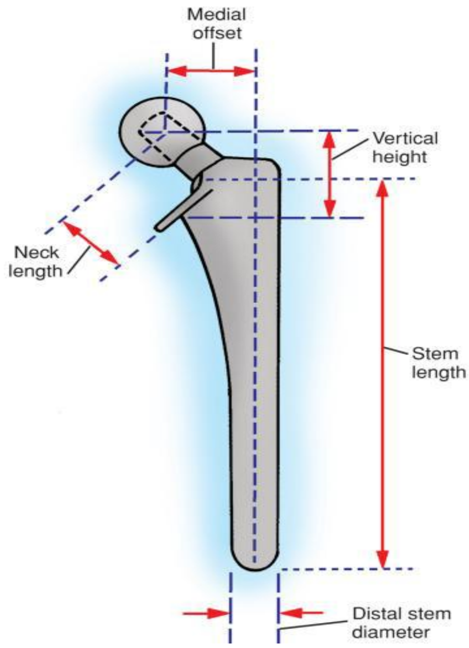
The vertical height of femoral head usually is measured as the distance to the center of the head from a fixed point, such as lesser trochanter. Restoring this distance is essential to correcting leg length. Using a stem with variable neck lengths provides a simple means of adjusting this distance.

Medial offset is the distance from the center of femoral head to a line through the axis of the distal part of the stem. Inadequate restoration of this offset shortens the moment arm of abductor musculature and results in increased joint reaction force, limp, and bony impingement, which may result in dislocation. Conversely, an excessive increase in offset results in increased stress within the stem and cement mantle that may lead to stem fracture or loosening. Offset is primarily a function of stem design.

Version refers to the orientation of the neck in reference to the coronal plane and is denoted as anteversion or retroversion. Restoration of femoral neck version is important in achieving stability of the prosthetic joint. The normal femur has 10 to 15 degrees of anteversion of the neck in relation to the coronal plane when the foot faces straightforward and the prosthetic femoral neck should approximate this[65,66].

Retroversion can result in posterior dislocation, especially when a posterior approach has been used. Anterior dislocation may occur in excessive anteversion of the prosthetic neck.

Figure 09: OFFSETS



Head and Neck Diameter [69,70]

If prosthesis with a small femoral head is used, the diameter of the neck must closely approach that of the head to make the neck strong enough, and the neck tends to impinge on the edge of the cup during a shorter arc of motion. The neck's impingement on the cup transfers a force to the edge of the cup and to the stem of the femoral component that tends to loosen the components and dislocate the joint. This impingement occurs at a lesser arc of motion when substantial wear of the socket has occurred.

The sockets for most of modern designs provide equatorial coverage in that the socket is the same depth as the radius of the head. In addition, the eveled edges of the cup around the socket allow a greater range of motion without impingement. Therefore the socket's depth and eveled edges and the greater diameter of the head in comparison to the neck in total hip systems with larger heads are features that allow a greater range of motion.

CO-EFFICIENT OF FRICTION AND WEAR[71,72,73]

It is the measure of resistance encountered in moving one object over another. It is 0.008 to 0.02 in normal joints. Metal on metal joints have been found to have co-efficient of friction of 0.8 and that of metal on high-density polyethylene approximately 0.02.

Frictional torque is the product of frictional force times the length of the lever arm and is less for smaller head. Since this frictional torque force is transmitted to the implant and cement, an increase in the torque force has been suspected as a cause of loosening of the component.

Wear is defined as loss of material from the surfaces of prosthesis, as a result of motion between their surfaces. Very smooth components of the total hip arthroplasty have undulating feels and valleys on their surface. When they first slide against each other, they are removed, leading to a high initial wear rate.

As the surface adapts to each other wear rate decreases, reaching a steady state. Reducing thickness of polyethylene to less than 5mm increases wear in the liner of acetabular cup. The greatest amounts of volumetric wear occur with 22mm component. Least amount of wear is associated with components of 28mm diameters.

DESCRPITION OF IMPLANTS

Since Sir Charnley performed the first modern hip replacements in the 1960's, there have been continuous advancements in the evolution of the hip replacement prosthesis. Despite continuing research for better implant materials, the classic combination of metal articulation with Ultra

High Molecular Weight Polyethylene (UHMWPE) remains the most widely used[64]. However, the choice of metals used in total joint implants has changed from Charnley's original stainless steel to stronger alloys based on either cobalt or titanium. Some of these changes have involved the materials used for the femoral stems and cups, the materials used for the ball bearing surfaces, whether or not cement is utilized.

FEMORAL COMPONENT[74]

The primary function of the femoral component is the replacement of the femoral head and neck after resection of the arthritic or necrotic segment.

Features of Femoral Component

The neck length is measured from centre of head to base of collar. The head-stem offset is from centre of head to line through axis of distal part of stem length and is measured from medial base of collar to tip of the stem.

Angle of neck is measured by intersections of line through centre of head and neck with another along lateral border of distal half of stem. Platform is the medial extension of collar.

Classification of Total Hip Femoral Components[74]

Cemented

Generally the stem should be fabricated of a high strength superalloy. Most favor cobalt –chrome alloy because its higher modulus of elasticity may reduce stresses within the proximal cementmantle. The cross-section of the stem should have a broad medial border and preferably broader lateral border to load the proximal cement mantle in compression. Stems are available in variety of sizes (4 to 6) to allow the stem to occupy approximately 80% of the cross section of the medullary canal with an optimal cement mantle of approximately 4 mm proximally and 2 mm distally. The lengths of current stem designs range from 120 to 150 mm.

Charnley	Matchett-Brown
Muller	Calandruccio
Aufranc-Turner	Sarmiento
Harris	

Uncemented

Cementless total hip stems are of two basic shapes;

Anatomical: The seincorporates a posterior bow in the metaphyseal portion and variably an anterior bow in the diaphyseal portion corresponding to the geometry of femoral canal. Right and left stems are therefore required and anteversion must be built in to the neck segment.

Straight: These have a symmetrical cross section and fit either side, reducing inventory. Porous coated metal: Porous stem designs differ in their materials, shape, location of porous surface and stiffness. Largely used metals are titanium and cobalt-chromium alloy because of superior biocompatibility, high fatigue strength and lower modulus of elasticity. The trend has been toward limiting the porous surface to the proximal portion of the stem, with the belief that proximal load transfer will reestablish a more normal stress pattern in the femur.

Harris-Galante

Lanceford

Hydroxyappatite coated

Press Fit: These devices have surface roughening or other surface modifications that provide a macrointerlock with the bone, but they have no capacity for bone ingrowth.

Judet Lord

Modular (capacity to independently size two portions of the prosthesis at time of surgery)

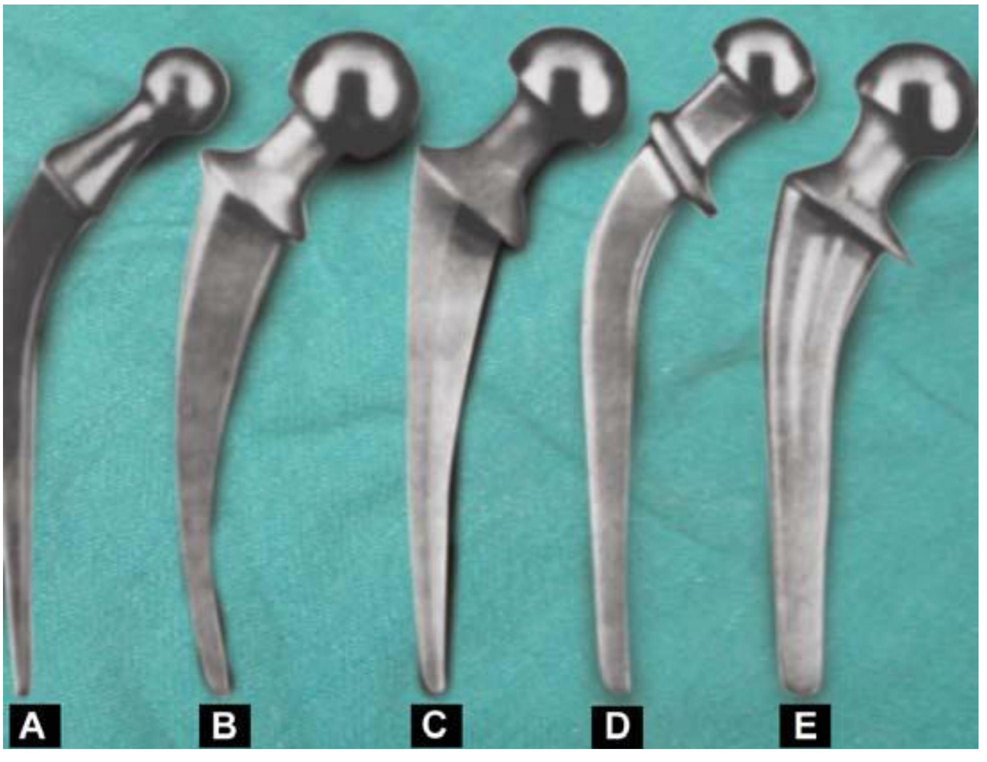
Custom made femoral components

It can be used in cemented or uncemented technique. It can be a press-fit or a porous coated cementless design. It is used in limb salvage procedures as in malignant or aggressive benign bone and soft tissue tumors and in revision surgeries.

Figure 10

From left to right: Original first-generation Charnley flatback, second-generation roundback stem, thirdgeneration, flanged Cobra stem, triple taper C-stem

Earlier designs of cemented femoral stems. (A) Charnley (B) Muller (C) Aufranc-Turner (D) Amstutz (E) Harris



ACETABULAR COMPONENTS[74, 75]

They can be classified as cemented or uncemented. Acetabular cups are made of ultra high molecular weight polyethylene (UHMWPE) or any metals used in orthopaedics.

CEMENTED CUPS

They are thick walled polyethylene cups. Polyethylene cup sockets vary in size from the original Charnley 22 mm diameter socket to 25, 26 and 32 mm. The outside diameter of most available cups (22 mm socket - Charnley) varies from 36 mm to approximately 60 mm. The outer surfaces of polyethylene cups have horizontal and vertical grooves that provide a larger surface contact with the surrounding cement. Wire markers in the coronal and sagittal plane are present on their surfaces for better post-operative roentgenographic interpretation of the position of the cup.

Circular wires at periphery is used to measure angle of anteversion, Semicircular wires in dome is used to measure angle of inclination.

The original Charnley plastic cup had a peripheral flange that helped trapping and pressurizing the cement in the acetabulum. The modified Charnley cup with a thin extended flange that could be trimmed to meet the individual needs was devised to avoid the loss of cement pressurization, especially in the superior aspect of the acetabulum.

The deep part of the socket is 2 mm deeper than the 11 mm radius of the head, and the surface of the more superficial part of the socket is located several millimeters below the plane of the peripheral flange.

The cup with an extended posterior wall was designed to provide more coverage of the head when the hip is flexed and internally rotated, and to eliminate the need of placing the cup in more anteversion. However the neck may impinge on the edge of the extended wall when the hip is extended. The same cup may be used for either hip and the letters 'L' and 'R' are imprinted on the flat surface to remind the surgeon that the extended wall must be placed posteriorly.

Cemented fixation is satisfactory in elderly, low-demand patients, and the simplicity and low cost of all polyethylene components make them an appealing option in this population.

UNCEMENTED CUPS

Most cups are porous coated. Various fixation methods of cups are available varying from transacetabular screws, pegs, spikes and enlarged peripheral rim. Of these, the most satisfactory fixation is provided by screws though it carries some risk to intrapelvic vessels and viscera and requires flexible instruments for screw insertion.

Most systems feature a metal shell with an outside diameter of 40 mm to 75mm that is used with a modular polyethylene liner. With this combination a variety of femoral head sizes, typically 22 mm, 26 mm, 28 mm, and 32 mm, can be accommodated according to the patient's need and surgeon's preference. The polyethylene line must be fastened securely to the metal shell.

In our study we have used **Muller's** type cemented modular stem component and cemented acetabular component with inner diameter of cup being 28mm for all the patients.

It is a fact of life that cost is increasingly becoming a factor in this aspect of the surgery, and in many places around the country, surgeons are at least somewhat limited by patients (and in some regions like ours, limited quite severely) to what choices of implants can be considered. In some cases, the newest and best prosthesis may cost more than the patient can afford.

Figure 11 : Cemented Acetabular Cups

Advantages and disadvantages of the cemented prostheses

Advantages:

The cemented total hip replacement can tolerate small deviations from the precise operation technique. The bed cut for the prosthesis in the skeleton need not to be very exact because the bone cement filler will level out all incongruities.

The patients can put weight on their new total hips immediately after the operation (in theory).Actually, the strength of the fixation of the cemented total hip to the skeleton is most strong at the end of the operation. The factor that limits full weight bearing is the surgical damage to the soft tissues around the total hip. These tissues must heal before the full weight bearing is possible.

The cement layer also acts as an intermediate bumper between the very stiff metal of the total hip prosthesis and the weak skeleton. This bumper levels the peak forces acting on the skeleton around the total hip during gait.

Most importantly for our study cemented implants are much cheaper than the uncemented ones which make them affordable by patients.

Disadvantages:

Besides concerns over mechanical loosening, however, cement can greatly complicate revision surgeries in which the interior of the bone has to be scraped or drilled extensively to remove old cement.

The pressing of the doughy bone cement into the raw bone marrow cavity during the operation may cause hypotension and other circulatory disturbances.

The other is that the bone cement ages, cracks, and after some time the bond between the prosthesis and the skeleton may be lost and implant becomes loose in few years.

INDICATIONS[62,64,76]

The 1994 National Institute of Health (NIH) consensus statement on total hip replacement concluded that "THR is an option for nearly all patients with diseases of the hip that cause chronic discomfort and significant functional impairment".

However in younger individuals, total hip replacement is not the only reconstruction procedure available for a painful hip.

Leaving aside the controversies, the following hip joint disorders can be considered as Indications for THR.

I. Degenerative joint diseases
   - Primary
   - Secondary

II. Rheumatoid arthritis

III. Ankylosing spondylitis

IV. Juvenile (Still's) rheumatoid arthritis

V. Pyogenic arthritis/osteomyelitis

VI. Turberculosis

VII. Developmental dysplasia of hip

VIII. Failed reconstruction
   - Osteotomies
   - Cup arthroplasty
   - Girdlestone
   - Total hip replacement
   - Resurfacing arthroplasty

IX. Tumors- involving proximal femur/acetabulum.

IX. Hereditary disorders –Achondroplasia.

Though the array of indications is extensive, yet the surgeon should first decide whether total hip replacement is the best operation for that particular diseased hip.

CONTRAINDICATIONS[62,64]

Total hip replacement is a major surgical procedure associated with a significant number of complications and a mortality rate of 1% to 2%. Consequently, the patients must be evaluated carefully, especially for systemic disorders and for general debility that may contraindicate an elective major procedure.

ABSOLUTE:

- Active infection of hip joint or any other region.
- Unstable medical illness increasing the risk of morbidity/ mortality.

RELATIVE:

- Any process that is rapidly destroying bone.
- Neurotrophic joints.
- Absent or relative insufficiency of abduction musculature.
- Rapidly progressive neurological diseases and obesity.

APPROACHES FOR TOTAL HIP REPLACEMENT[64, 77, 78]

There are four standard approaches used i.e. Anterior, Anterolateral, Posterior and Transtrochanteric.

In our study we took a posterior approach in all the patients.

POSTERIOR APPROACH

Moore's approach has been facetiously labeled "the southern exposure."

Salient features

- The approach is largely bloodless and the access to the hip joint is safe and easy.
- It provides excellent visualization of the femoral shaft, hence is the preferred approachfor a revision of the femoral component.
- Does not interfere with the abductor mechanism.

Technique

- The patient is placed on lateral decubitus position.
- Start the incision approximately 10 cm distal to the posterior superior iliac spine, and extend it distally and laterally parallel with the fibers of the gluteus maximus to the posterior margin of the greater trochanter. Direct the incision distally 10 to 13 cm parallel with the femoral shaft.
- Expose and divide the deep fascia in line with the skin incision.
- By blunt dissection, separate the fibers of the gluteus maximus; take care not to disturb the superior gluteal vessels in the proximal part of the exposure.
- Retract the proximal fibers of the gluteus maximus proximally, and expose the greater trochanter. Retract the distal fibers distally, and partially divide their insertion into the linea aspera in line with the distal part of the incision.

- Expose the sciatic nerve and retract it carefully. (After the surgeon becomes familiar with this approach, he or she rarely exposes the sciatic nerve). Divide a small branch of the sacral plexus to the quadrates femoris and inferior gemellus, which contains sensory fibers to the joint capsule.
- Expose and divide the gemelli and obturator internus and, if desired, the tendon of the piriformis at their insertion on the femur, and retract the muscles medially.
- The posterior part of the joint capsule is now well exposed; incise it from distal to proximal along the line of the femoral neck to the rim of the acetabulum.
- Detach the distal part of the capsule from the femur.
- Flex the thigh and knee 90 degrees, internally rotate the thigh, and dislocate the hip posteriorly.

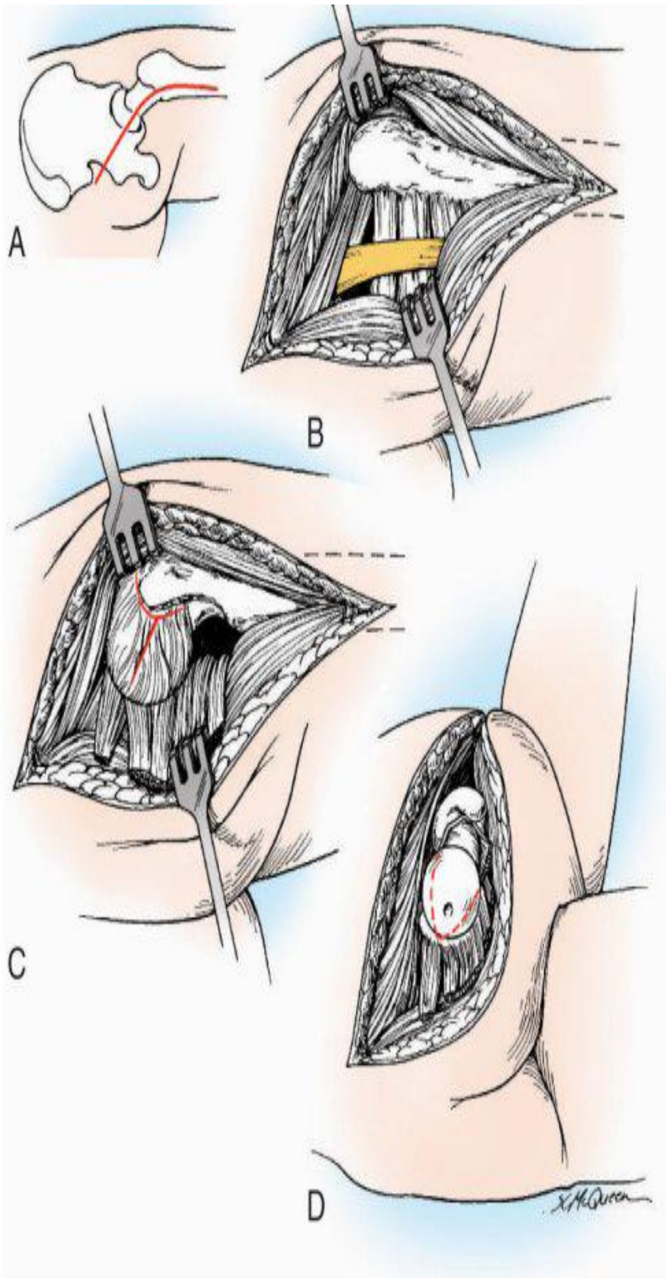


Figure 12 : Showing steps in Posterior (Moore's) Approach

a. **Skin Incision**

b. **Gluteus Maximus split with it fibres,short external rotators seen**

c. **Short external rotators detached from femur and joint capsule exposed**

d. **Joint capsule opened and hip joint dislocated by flexing,adducting and internally rotating thigh.**

COMPLICATIONS OF TOTAL HIP REPLACEMENT[79]

a) Early

- Nerve palsy
- Vascular injury/Haematoma formation
- Thromboembolism
- Bladder injuries

b) Late

- Aseptic loosening
- Implant failure
- Osteolysis
- Heterotopic ossification

c) Time independent

- Infection
- Dislocation
- Trochanteric non union and migration
- Limb length discrepancy
- Peri-prosthetic fractures

Nerve Injuries [64,79,80]

The Sciatic, Femoral, Obturator and Peroneal nerves may be injured by direct surgical trauma, traction, pressure from retractors, extremity positioning, limb lengthening, thermal or pressure injury from cement.

The incidence of nerve injury has been reported to be 0.7% to 3.5% in primary arthoplasties whereas 7.5% incidence of nerve palsies after revision procedures have been reported.

Based on clinical and electromyographic studies, it is concluded that subclinical nerve injury is the rule rather than the exception and is usually caused by surgical trauma.

No statistical difference in the incidence of sciatic palsy comparing the posterior to the lateral transtrochanteric approach has been found. But nerve palsies are common in revision procedures.

Sciatic nerve injury

Commonest injured nerve and is usually caused by injudicious retraction of soft tissues along the posterior edge of the acetabulum which may cause a stretch injury or direct contusion of the nerve.

The amount of lengthening with the development on nerve palsy have been correlated, injury to peroneal branches occurred with lengthening of 1.9 to 3.7 cm. Complete sciatic nerve palsy occurred with lengthening of 4 to 5.1 cm.

Subgluteal hematoma caused by anticoagulant use, dislocations in the perioperative period and thermal injury due to the entrapment of nerve in cement mass are other cause of sciatic nerve injury.

Revision procedures - Surgical exposure is technically difficult and the complexity of reconstructive procedures may injure sciatic nerve. Somatosensory

Evoked Potential (SSEP) monitoring of sciatic nerve during revision procedures showed neurological compromise in 32% of patients primarily caused by excessive retraction during exposure of the posterior aspect of acetabulum and by extremes of positioning of the extremity of femoral cement removal.

Femoral nerve

Simons et al. reported femoral nerve palsy in 2.3% of patients, all occurring when a Hardinge lateral approach was used. It may be injured by retractors placed anterior to iliopsoas or during anterior capsulotomy or retractors for acetabular preparation. The nerve may also be compressed by extruded cement if acetabular cement pressurization is used. Nerve palsies due to correction of severe flexion contractures have also been observed.

The prognosis for recovery is good, except when the nerve is encased in extruded cement. The patient should wear a knee immobilizer for walking to prevent knee buckling and falls while the quadriceps remains weak.

In our study it was found that in one patient there was sciatic nerve neuropraxia it was due to excessive stress on the nerve intraoperatively, patient was advised passive dorsiflexion and plantarflexion exercises and was given below knee prosthesis to prevent equines deformity. Patients recovered from the neuropraxia in 6 weeks.

Dislocation and Subluxation [64,81, 82, 83, 84]

The average incidence of dislocation after total hip arthroplasty is approximately 3%.

The following are the causes

- Post-operative dislocation is more common when there has been previous surgery on the hip and especially approaches 20% with revision.
- Posterior surgical approach was found to be increasing the rate of postoperative dislocation. It was found that dislocation rate was about 5.8% when a posterolateral approach was used, while it was 2.3% when an anterolateral approach was used. There is a tendency to retrovert the socket when THR is performed through a posterolateral approach. Division of all the short rotators is another factor, and meticulous repair of the posterior soft tissue envelope improves stability.
- The orientation of the cup especially with respect to anteversion causes anterior dislocation during extension, adduction and external rotation whereas retroversion causes posterior dislocations during flexion, adduction and internal rotation. Excessive inclination of the cup causes superior dislocation with adduction, especially if there is residual adduction contracture or if the femur impinges on osteophytes left along the inferior margin of the acetabulum. Conversely, if the cup is inclined almost horizontally, impingement occurs early in flexion and the hip dislocates posteriorly. Hence it is mandatory that surgeon should be able to judge the position of the patient's pelvis in both the horizontal and vertical planes.
- The definition of the angle of anteversion is the angle that the axis of acetabulum makes with the coronal plane of the body. Therefore a "safe range" has been described. Anteversion of 15+10 degrees and inclination of 40+10 degrees is accepted. Within this safe range, if the acetabular

component is fitted the dislocation rate was found to be 1.5%, whereas it was 6.1% when the safe range was violated.

- The placement of femoral component also plays an important role. The anteversion of femur is the angle between the axis of the femoral neck and the axis of the knee joint in the coronal plane.

  The femoral component should be fixed with the neck in 5-10 degrees of anteversion. Excessive anteversion causes anterior dislocation, whereas retroversion causes posterior dislocation. If both the cup and the neck of the femoral component are placed in 15 degrees or more of anteversion, the combination will result in dislocation.

- Bone or cement protruding beyond the flat surface of the cup will act as a fulcrum to dislocate the hip in the direction opposite their location.
- Impingement of the neck of the femoral component on the margin of the socket may tend to lever the head out of the cup.
- Abductor weakness caused by pre-existing neurological defect is a causative factor in postoperative dislocation.
- It was found that dislocation rate was 17.6% in patients with displaced trochanteric non unions, compared with 2.8% when the trochanter healed by osseous or fibrous union without displacement.
- Non compliance of extremes of positioning in the per-operative period is an important cause of dislocation. If the components are not much damaged (as indicated by roentgenographic evaluation) in cases of dislocations recognized early, it can be reduced by gentle closed methods. If detected several hours later, closed reduction may not be possible because of spasm and swelling, in those cases open reduction has to be done.

If there is damage to the components as evidenced by x-ray then a revision arthroplasty must be done. When instability is compounded by neurological deficit or abductor inefficiency, revision to a bipolar prosthesis may be done.

In our study we had 2 cases (07%) of posterior dislocations in our study. One case got dislocated on the 5th post – operative day while the patient was trying to squat in the bed and the other occurred after the patient was discharged from our institution 8 months after surgery due to Road traffic accident. Both the cases were managed by closed reduction following Allis' technique and fixed skin/ in one patient and skeletal traction in another patient for 2 weeks.

The patients were then discharged and regularly followed- up. No further episodes of redislocation were noted.

Limb Length Discrepancy [64,85,86,87,88]

Lengthening may result from

1. Insufficient resection of bone from the neck
2. use of prosthesis with a neck that is too long
3. changing the acetabulum's centre of rotation
4. Correcting the varus position of the femoral neck and lateralizing the acetabulum to more anatomical position in patients with intra pelvic protrusion.

In a study it was found that an average lengthening of 9.7mm was seen; more than half of those with lengthening were disturbed by it.

In another study it was reported that out of 150 patients, 144 had limb lengthening averaging 1.6cm, and 27% had symptoms severe enough to require a lift on the opposite side.

The functional significance of leg length inequality after total hip arthroplasty has not yet been well defined. If lengthening exceeds 2.5 cm, sciatic palsy may result. A correlation between leg length discrepancy and onset of low back pain, prematuremechanical failure has not been linked. However, leg lengthening in excess of approximately 1cm frequently is a source of significant patient dissatisfaction.

Shortening of the limb by excessive neck resection or use of prosthesis with a neck that is too short poses the risk of dislocation because of inadequate soft tissue tension or impingement.

Currently, the most reliable method of equalizing leg lengths is the combination of preoperative templating and intra-operative measurement. When both hips are diseased and bilateral staged surgery is expected, length is determined by the stability of the hip and leg lengths were equalized by making the same bony resection and using the same implants on both sides.

In our study on a average there was lengthening of 0.6cm but no patients were discomfort accept for 3 patients who had lengthening of more than 1.5cm.

MATERIALS AND METHODS

SOURCE OF DATA:

Our study was conducted between the periods of September 2012 to August 2014 in B.L.D.E University, Shri. B. M. Patil Medical College, Hospitaland Research Centre, Bijapur. 25 patients of hip disorders were treated with cemented total hip replacement. The patients were informed about study in all respects and informed written consent was obtained. Ethical Clearance for this study was obtained from the committee.

INCLUSION CRITERIA:

a) Patient who are considered for hip replacement.

b) Age group adults above 18years.

c) C-Reactive protein negative

EXCLUSION CRITERIA:

a) Age group of less than 18 years.

b) Patients not fit for surgery.

c) Associated other bony injuries to ipsilateral limb.

Sample Size:

In case of any statistical analysis and in the presence non availability of prevalence and incidence rate, the sample size 30 and above is sufficient to study the significance of the procedure. This is because all standard statistical distribution will merge into normal distribution. Further the conclusion/inference that can be drawn using sample size moe than 30 will be almost remain same as n=30[89].

The statistical analysis of this study is taken up with n=30.

All cases each one satisfying inclusion and exclusion criteria given above were selected by purposive sampling in the period of September 2012 to February 2014 so that the last case to has a follow up period of 6 months and over duration of study would be from September 2014 to August2014.

Patient Selection and Procedure of the Study:

On admission to the ward, a detailed history of the patients was taken according to proforma was taken. Following this, they were subjected to a thorough clinical examination and general condition was assessed and accordingly corrective measures were taken to correct the general being of the patients.

Routine blood investigations were done for all the patients. Special attention was paid to CRP and ESR and if these were abnormal, surgery was deferred. Standard anteroposterior and lateral X-rays were taken including pelvis with both hips. Analgesics, antibiotics, tetanus toxoid and blood transfusions were given as needed before surgery.

Pre-operative Assessment:

The patients were evaluated according to the modified Harris hip scoring system. The scores taken into account were of pain, function, range of motion, and deformities. Also a mention of the limb length discrepancy and flexion contracture is made.The physical fitness of the patient undergoing a major surgery was assessed. Physical examination included examination of spine and both lower extremities including opposite hip, both knees and foot. Trendelenburg test to assess the abductor musculature mechanism was done.

Neurovascular status of affected extremity was evaluated. Any occult infections like skin lesions, dental caries and urinary tract infections were identified and treated preoperatively.

Radiographic evaluation:

The goal of preoperative radiographic assessment is to confirm the diagnosis, to determine anatomic relationship of the femur and pelvis to allow for accurate restoration of joint anatomy and biomechanics. Standard pelvic roentgenogram AP view with both hips along with upper end femur in 15 degrees of internal rotation and lateral X-ray of hip were taken. Following features were noted:

Femur: Bone stock, medullary cavity, limb length discrepancy and neck.

Acetabulum: Bone stock, floor, migration, protrusion, osteophytes and approximate cup size.

Pre operative planning:

The general goals are

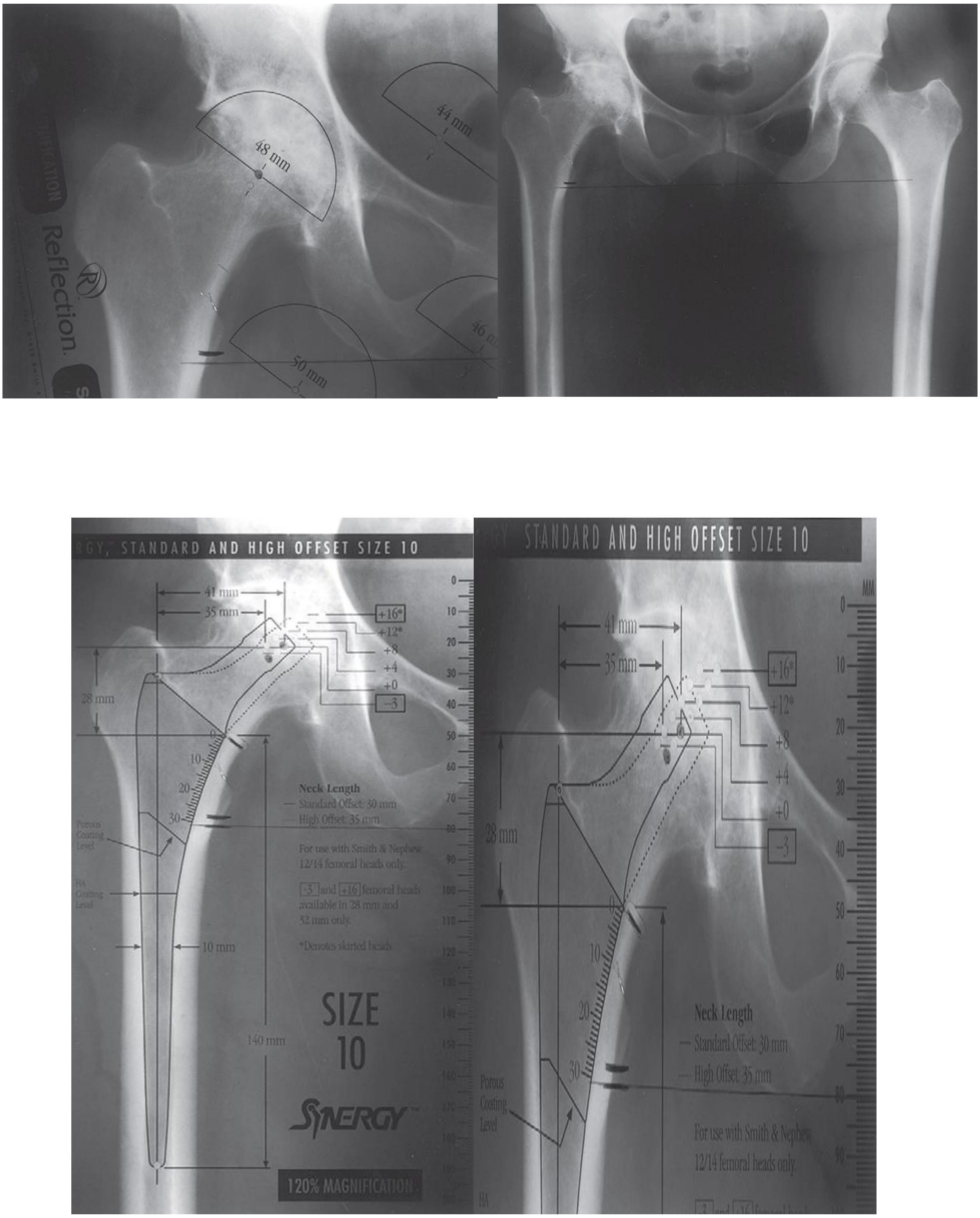
- To determine the type of implant and size of implant (TEMPLATING).
- To restore anatomical and bio-mechanical centre of rotation of hip.
- To restore appropriate muscle relationships.
- To anticipate any problem likely to be met and planning for them too preoperatively

-Preoperatively templeting was carried out routinely

-Components of appropriate sizes were kept ready.

Antibiotic prophylaxis was given one hour prior to surgery in all cases.

Figure 13 : Templating of Radiographs for Pre-op Planning



Surgical Procedure

All surgeries were performed on an elective basis using standard aseptic precautions under spinal anaesthesia and epidural anaesthesia.

Position of the patient:

Lateral position with the patient lying on the unaffected side. The skin over the hip was scrubbed with povidone-iodine. The lower extremity from the groin to the toes was drapped in sterile towels separately to enable easy manipulation of the limb during surgery.

Approach: For all patients posterior approach (modification of Gibson’s and Moore's Approach) was used in our series.

Preparation and draping

The first assistant who has scrubbed and applied sterile gloves prepares the lower limb from a level well proximal to the umbilicus and including the groin and antero medial part of opposite thigh. The foot is held by another assistant who now abducts the limb thereby elevating the buttock which is prepared. The first assistant uses a pad to hold the ankle and thereby prepares the foot and toes. After this adductor tenotomy, if needed, is done in a sterile condition.

Following this, the surgical teams proceed with the sterile draping of the limb. Four double sheets along with an adhesive sheet are used to isolate the lower limb from the perineum and rest of the body providing atleast four layers of drapes and isolating the head end of the patient and anaesthetist from the field. The lower limb is now received into two sets of double towels and bandaged. A stockinette is then applied over the entire lower limb upto the pelvis. The stockinette is then cut over the skin incision site.

An iodine coated adhesive sheet is now applied to the exposed skin and surrounding drapes. The surgeon and his assistants wore wrap around gowns after scrubbing.

Technique

The incision, superficial and deep dissection was done as per the Moore's approach and the femoral head is exposed after incising the capsule. The head is dislocated by flexion, adduction and internal rotation. If internal rotation is restricted a capsular and psoas release can be done for facilitation of the rotation and dislocation of the hip.

- Osteotomise the neck at pre-planned level using saw or sharp osteotome.
- For acetabular exposure, place anterior swan neck retractor along anterior lip of acetabulum after making a capsular opening. Place Hohman's retractor below transverse ligament. Retract posterior soft tissues with a right angle retractor or posterior cobra retractor with hip in extension.
- Complete the excision of capsule and labrum to provide 360 degrees exposure of the bony margins of the rim of acetabulum. Remove osteophytes that protrude beyond the bony limits of true acetabulum.
- Excise fibrofatty tissue, ligamentum teres and medial/inferior osteophytes to expose medial wall of acetabulum. This depth indicates the limit to which acetabulum can be safely deepened.
- Direction of reamer should be 45 degrees to longitudinal axis of body and 15 degrees of anteversion. Push reamer posteriorly to keep away from anterior wall.

- Reaming is completed when all cartilage is removed and reamer has cut bone out to the periphery of acetabulum to expose bleeding subchondral bone. Protect and retain subchondral bone of the roof as much as possible.
- Select the correct size of the acetabular cup using acetabular gauges. Place trial cup in 45-50 degrees of inclination. Note orientation and containment of the cup.Make 6 mm anchor holes throughout the acetabulum. Larger l0 mm holes may be made in ilium and ischium.
- Clean the anchor holes with a currette. Use copious wash to clean the acetabular floor and pack the cavity with hydrogen peroxide pack. Attach cup to holder in the correct orientation of long posterior wall.
- For preparation of the femur, rotate femur internally so that tibia is perpendicular to floor while covering the acetabulum with a sponge. Deliver proximal femur from the wound by pushing on the knee and keeping a toothed cobra retractor below the neck. Retract posterior edge of gluteus medius to expose piriformis fossa.
- Remove soft tissue from lateral aspect of neck and piriformis fossa with rongeur. Remove bone from lateral portion of neck and medial aspect of greater trochanter to form a groove. This prevents varus placement of the prosthesis.
- Insert tip of initial reamer into lateral aspect of the neck and swing the reamer into greater trochanter so that it points towards medial femoral condyle. Follow this with a large reamer. Curette loose cancellous bone from the medial aspect of neck.
- Insert the trial stem, cup and head (as system is Modular) and do trial reduction. Note range of movements, stability of the joint and limb length

correction. Not more than 5 mm separation should be present on traction on the limb.

- The acetabular cup placement is done. After the cement is mixed, its setting goes through three stages i.e. hairy stage, scrotal stage and doughy stage. The cement is inserted when it reaches the doughy stage where the cement doesn’t stick to the gloves.
- Use fingers to push cement into anchor holes. The cup clipped to cup holder is pushed into the depth of acetabulum pressing on to the cement with cup holder directed toward the patient's foot. Cup pusher is then positioned in to the depression in the cup holder to keep the cup in the depth of acetabulum while the handle is brought up towards patient's head.
- Handle is brought into final orientation where the transverse arm is parallel to transverse axis of pelvis and 5 to 10 degrees anteversion. Trim the extruded cement with knife and remove with a curette. Maintain pressure till cement polymerizes. Look for and remove if any impinging osteophytes or cement projections are found.
- Finally, the femoral component is inserted. Plug the femoral canal with bone plug 2-3 cm below anticipated tip of stem. Irrigate the canal to remove loose debris, bone marrow and blood. Pack the cavity with hydrogen peroxide sponge. Insert a drain tube on medial aspect of femoral neck.
- Mix the cement and make a roll out of it when it reaches the doughy stage. Insert it into medullary canal. Push the cement with tip of index finger going right inside the medullary canal.Insert the prosthesis in predetermined direction and anteversion. Impact the stem with an impactor. Remove the

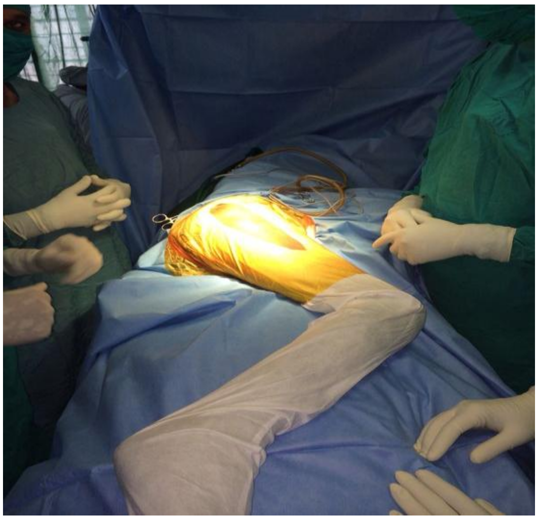
extruded cement with knife or a curette. Reduce the hip after cement polymerizes.

- Closure is then done. Reattach short external rotators through drill holes made in posterior aspect of greater trochanter. Suture fascia, subcutaneous tissue and skin in layers. Drain is inserted.

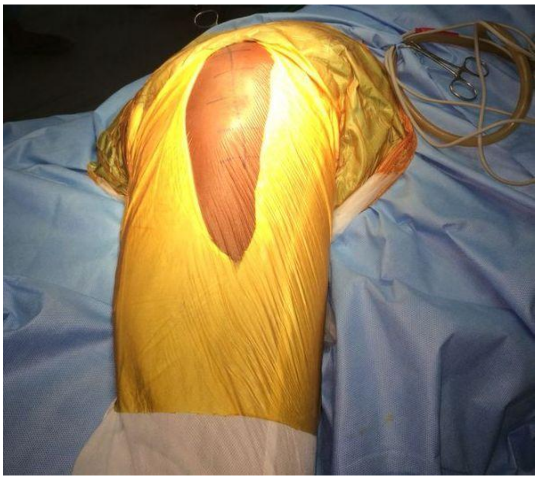
OPERATIVE PHOTOGRAPHS

Instruments

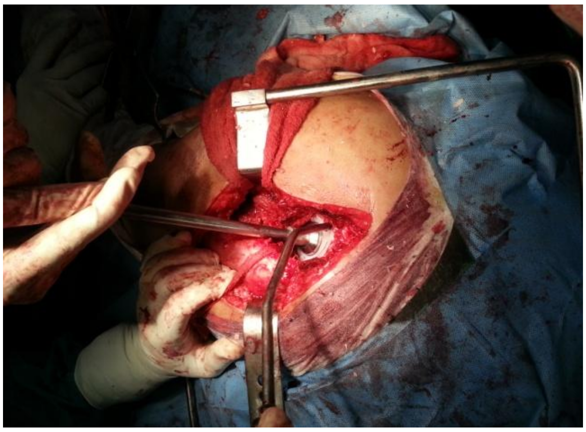
Positioning, Painting and Draping of the Patient



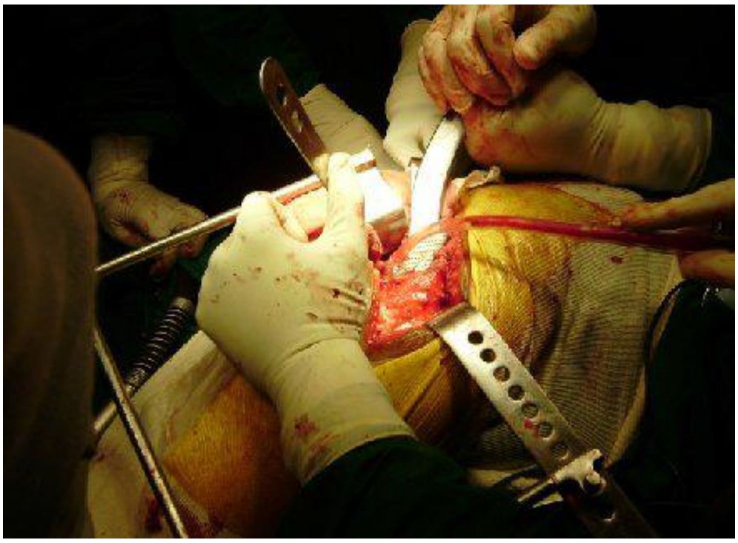
Incision and femoral head extraction



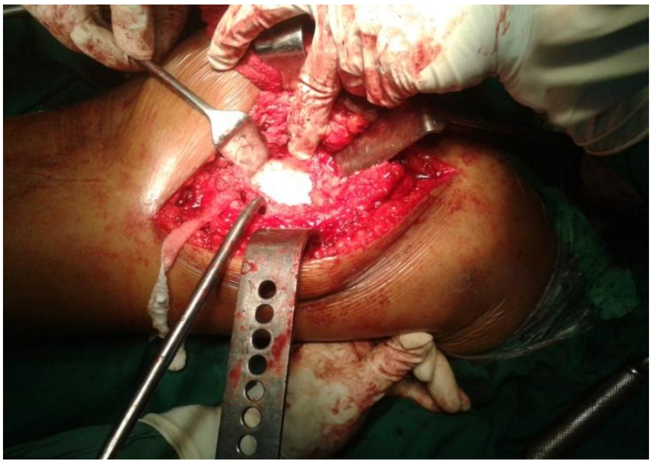
Acetabulum reaming



Femoral Preparation

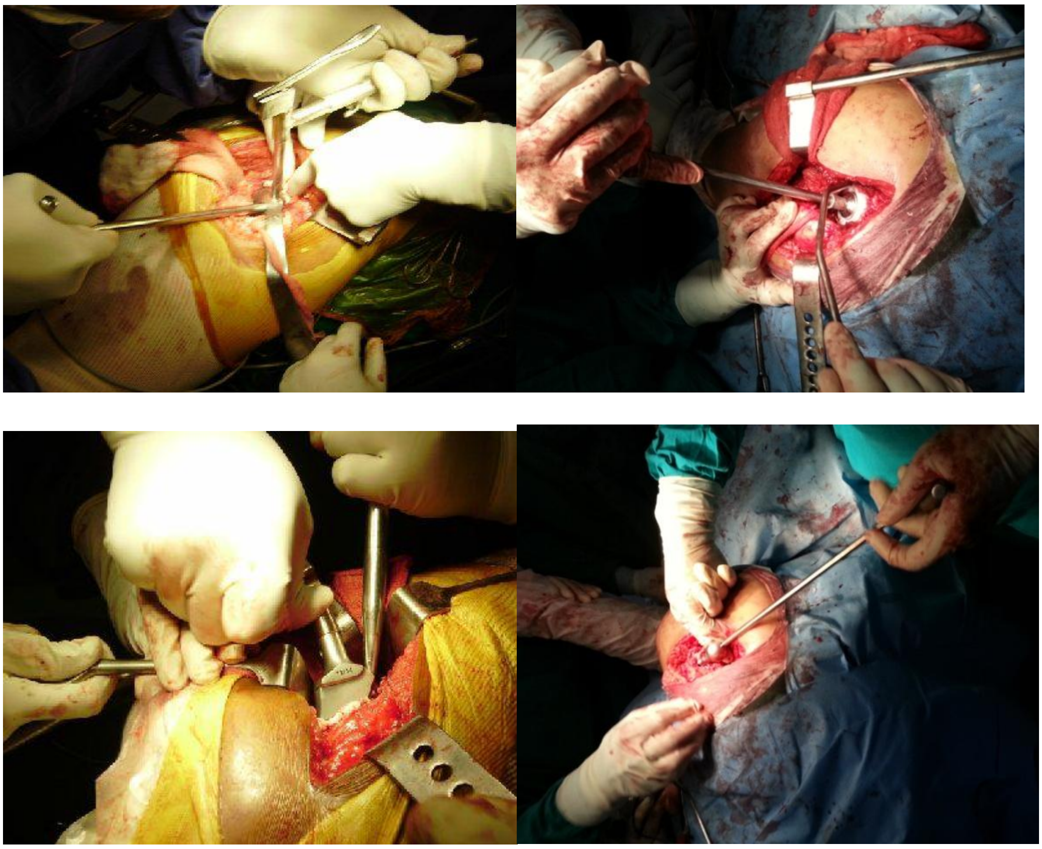


Cementing into reamed aceatbulum



Cementing ino the femoral part with help of gun

Acetabulum cup and Femoral components placements



Reduction and short external rotators closure

Final closure with drain fixed

Suture Removal on 12th post op day

POST OPERATIVE MANAGEMENT

- The limbs were kept abducted with the help of pillows.
- Vitals are monitored carefully for 48 hours.
- Intravenous antibiotics were continued for first three days and then it shifted to oral.
- Suction drainage was removed after 72 hours depending on the amount of collection if collection <20ml in 24hrs
- Static quadriceps started on the first post-operative day.
- Active quadriceps and hip flexion exercises were started on the 2^{rd} and 3^{th} post operative day.
- Dressing done on 2^{nd}, 5^{th} and 8^{th} post operative day.
- Sutures removed on 12^{th} post operative day.
- Patient was advised regarding partial weight bearing, walking started at about 4-5 days post operatively with the help of a walker.
- Full weight bearing walking allowed after radiological and clinical assessment.

Follow Up

At the time of discharge the patients were asked to come for follow up after 6 weeks and for further follow up at 3 months and 6 months. Thereafter every six months. The patients who turned for follow up were finally taken up for the assessment of functional results. At follow up, detailed clinical examination was done systematically.

Patients were evaluated according to Harris hip scoring system for pain, limp, the use of support, walking distance, ability to climb stairs, ability to put on shoes and socks (in our study for some patients ability to cut toenail was enquired) sitting on chair, ability to enter public transportation, deformities, leg length discrepancy and movements. All the details were recorded in the follow up chart. The radiograph of the operated hip was taken at regular intervals, at each follow up.

CRITERIA FOR EVALUATION AND RESULTS [HARRIS HIP RATING[90]

The functional results of the patients were evaluated as follows.

1. Pain (44 possible)
    a. None or ignores it (44)
    b. Slight, occasional, no compromise in activities (40)
    c. Mild pain, no effect on average activities, rarely moderate pain with unusual activity; may take aspirin (30)
    d. Moderate Pain, tolerable but makes concession to pain, some limitation of ordinary activity or work, May require occasional pain medication stronger than aspirin (20)
    e. Marked pain, serious limitation of activities (10)
    f. Totally disabled, crippled, pain in bed, bedridden (0)

2. Gait (33 possible)
    a. Limp
        - None (11)
        - Slight (8)
        - Moderate (5)
        - Severe (0)
    b. Support

- None (11)
- Cane for long walks (7)
- Cane most of time (5)
- One crutch (3)
- Two canes (2)
- Two crutches or not able to walk (0)

c. Distance Walked

- Unlimited (11)
- Six blocks (8)
- Two or three blocks (5)
- Indoors only (2)
- Bed and chair only (0)

3. Activities (14 possible)

a. Stairs

i. Normally without using a railing (4)

ii. Normally using a railing (2)

iii. In any manner (1)

iv. Unable to do stairs (0)

b. Shoes and socks

i. With ease (4)

ii. With difficulty (2)

iii. Unable (0)

c. Sitting

i. Comfortably in ordinary chair for one hour (5)

ii. On a high chair for 30 minutes (3)

iii. Unable to sit comfortably in any chair (0)

d. Enter public transport (1)

4. Absence of deformity – (4 points are given if patient demonstrates)

   a. Less than 30° fixed flexion contracture

   b. Less than 10° fixed abduction

   c. Less than 10° fixed internal rotation in extension

   d. Limb length discrepancy less than 3.2 cm

5. Range of motion (5 points possible)

(Index values are determined by multiplying the degrees of motion possible in each are by the appropriate index)

A. Flexion			(max possible)
0-45^{o}	x	01	45
45-90^{o}	x	0.6	27
90-100^{0}	x	0.3	06
>100^{o}	x	00	00
B. Abduction			
0-15^{o}	x	0.8	12
15-20^{o}	x	0.3	1.5
>20^{o}	x	00	00
C. External rotation in extension			
0-15^{0}	x	0.4	06
Over 15^{0}	x	00	00
D. Internal rotation in extension			
Any	x	00	00
E. Adduction			
0-15^{o}	x	0.2	03

Over 15^{o}	x	00	00
F. Extension			
Any	x	00	00
		Total -	100.5 pts

To determine the overall rating for the range of motion, multiply the sum of the index values by 0.05

Maximum points possible = 100.5 x 0.05

= 5 points

Maximum points possible - 100

- EXCELLENT 90- 100
- GOOD 80-89
- FAIR 70-79
- POOR < 70

RESULTS

This series consisted of 30 patients with 30 diseased hips treated with cemented total hip replacement between September 2012 to August 2014. The follow-up was for a minimum of 6 months to maximum of 2 years. Results were analyzed both clinically and radiologically.

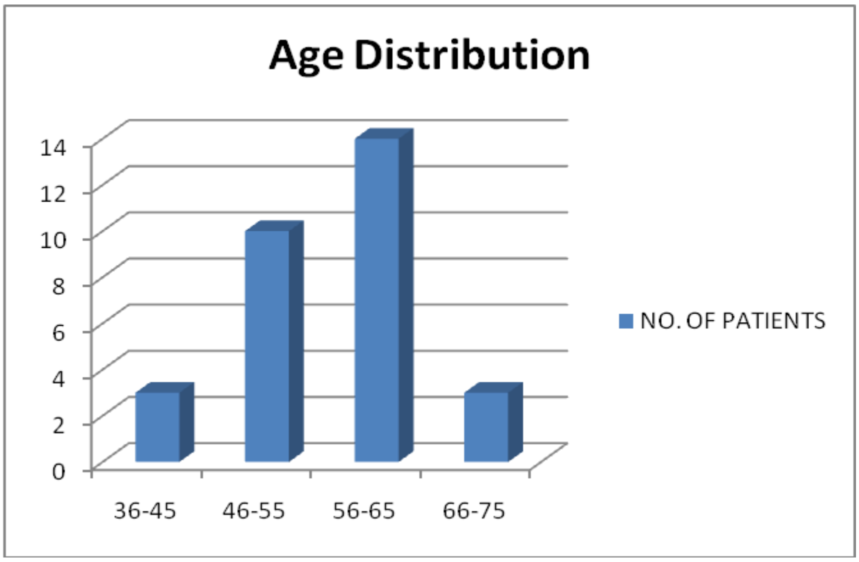
AGE DISTRIBUTION

Out of 30 patients, 3patients(10%) belonged to age 36-45, 10 patients (33%) belonged to the age group between 46-55 years of age. 15 patients (47%) belonged to age group between 56-65 years of age and 3 patients (10%) were in the age group between 66-75 years of age.

Table 1: Age Distribution

AGE IN YEARS	NO. OF PATIENTS	DISTRIBUTION
36-45	03	10%
46-55	10	33%
56-65	14	47%
66-75	03	10%

Graph-1



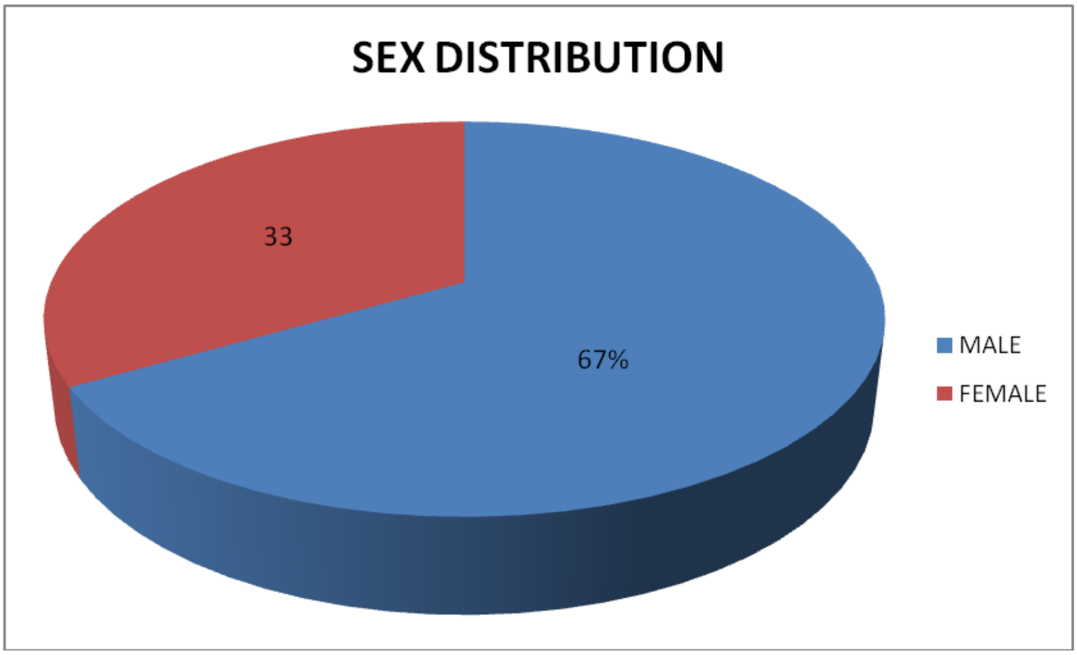
SEX DISTRIBUTION

Out of 30 patients, 20 (67%) were males and 10 (33%) were females, thus showing a male preponderance.

Table 2: Sex Distribution

SEX	NO. OF PATIENTS	DISTRIBUTION
MALE	20	67%
FEMALE	10	33%

Graph-2



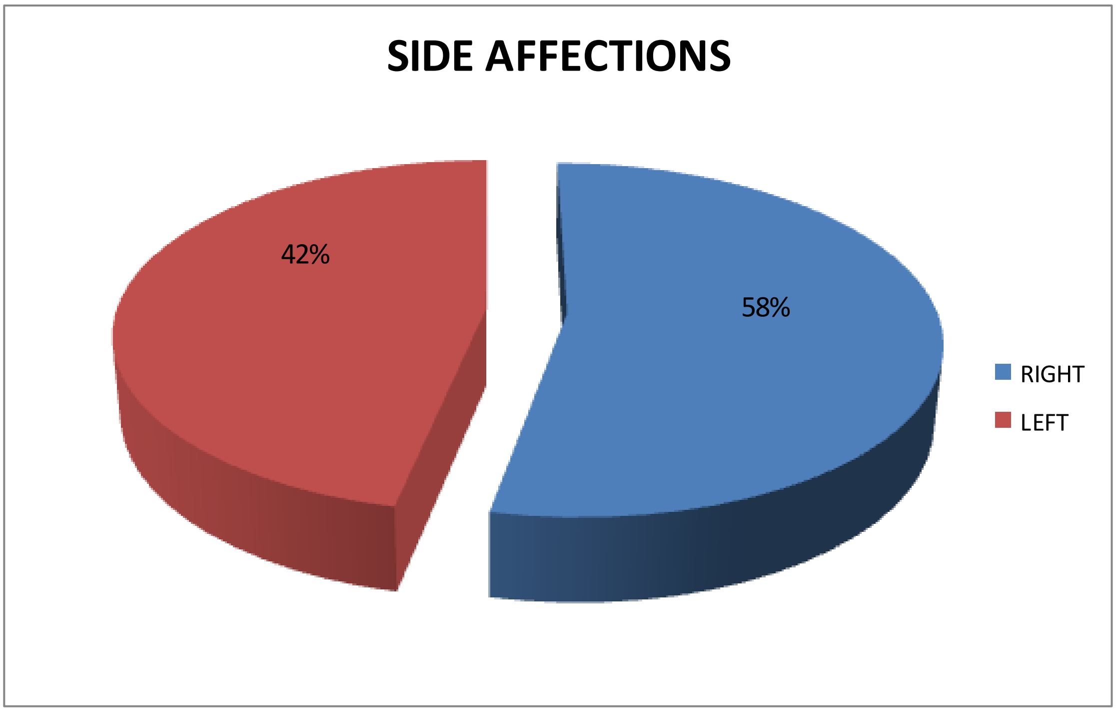
SIDE AFFECTED

In our study, 16 (58%) patients had right side affection and 14(42%) patients had left side affections.

Table 3: Side Affected

SIDE AFFECTED	NO.OF PATIENTS	DISTRIBUTION
RIGHT	16	58%
LEFT	14	42%

Graph-3



INDICATIONS

The most common indication for surgery was secondary osteoarthritis of patients being 15 (50%). The other causes were non union fracture neck of femur 11 (37%), rheumatoid arthritis 3(10%) and neglected dislocation of hip 1(3%).

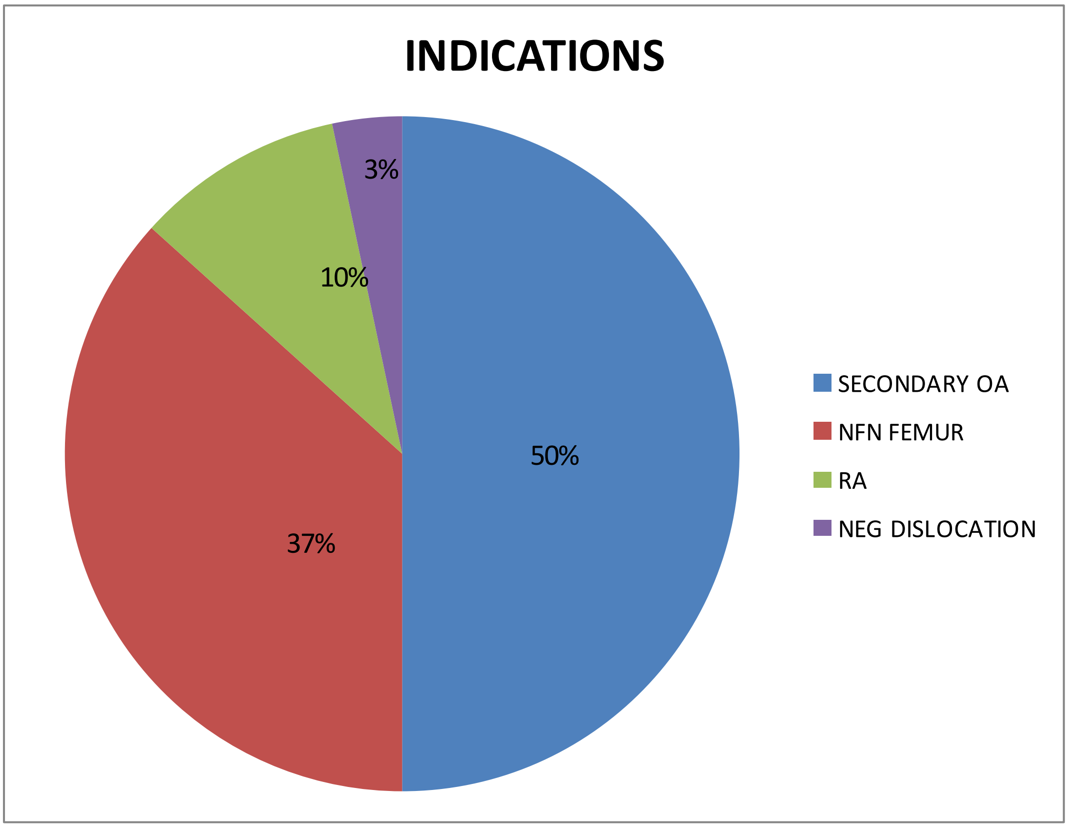
The causes of secondary osteoarthritis of the hip were

- Advanced stages of avascular necrosis of the head of femur – 08
- Old Inter-trochanteric fractures with implant failure – 02
- Healed tuberculosis – 02
- Old trauma to hip joint – 02
- Ankylosing Spondylitis- 01

Table 4: Indications

INDICATIONS	NO. OF PATIENTS	DISTRIBUTION
SECONDARY OA	15	50%
NON UNION FRACTURE NOF	11	37%
RHEUMATOID ARTHRITIS	03	10%
NEGLECTED DISLOCATION	01	3%

Graph-4



COMPLICATIONS

Dislocation

We had 2 cases (10%) of posterior dislocations in our study. One case got dislocated on the 5th post – operative day while the patient was trying to squat in the bed and the other occurred after the patient was discharged from our institution 8 months after surgery due to Road traffic accident. Both the cases were managed by closed reduction following Allis' technique and fixed skin/ skeletal traction.

The patients were then discharged and regularly followed- up. No further episodes of redislocation were noted.

Nerve Injury:

In our study it was found that in one patient there was sciatic nerve neuropraxia it was due to excessive stress on the nerve intraoperatively, patient was advised passive dorsiflexion and plantarflexion exercises and was given below knee prosthesis to prevent equines deformity. Patients recovered from the neuropraxia in 6 weeks. Weight bearing was delayed in this patient.

Limb Length Discrepancy:

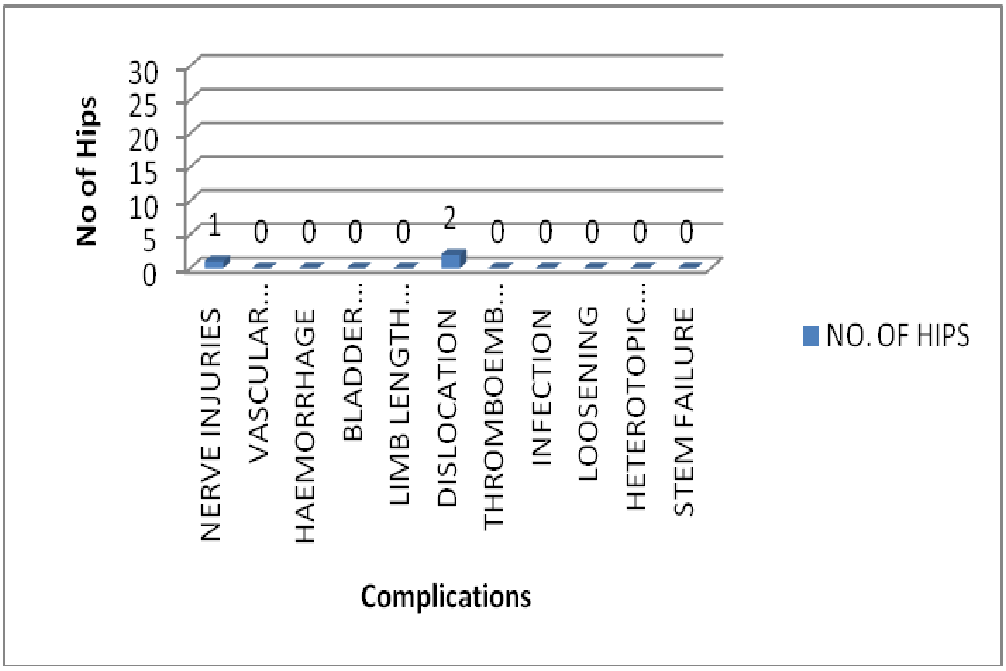
In our study on a average there was lengthening of 0.7cm but no patients were discomfort accept for 3 patients who had lentheninging of more then 1.5cm.

No other complications were noticed in the patients during the period of this study.

Table 5: Complications

COMPLICATIONS	NO. OF HIPS	DISTRIBUTION
NERVE INJURIES	**1**	**3%**
VASCULAR INJURIES	-	-
HAEMORRHAGE	-	-
BLADDER INJURIES	-	-
LIMB LENGTH DISCREPANCY	-	-
DISLOCATION	**2**	**7%**
THROMBOEMBOLISM	-	-
INFECTION	-	-
LOOSENING	-	-
HETEROTOPIC OSSIFICATION	-	-
STEM FAILURE	-	-

Graph-5



HARRIS HIP SCORE (MODIFIED)

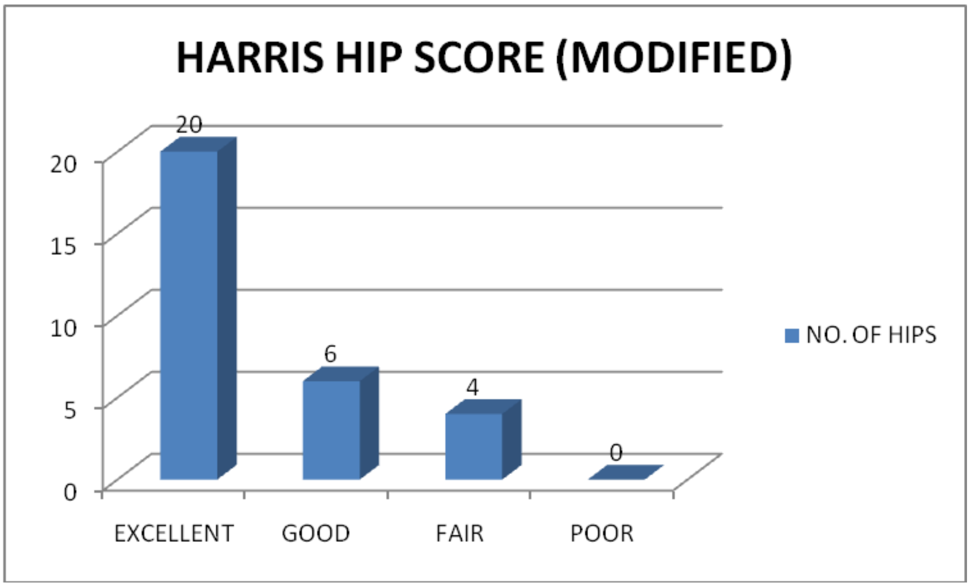
Functional outcome of the procedure was done by following the Harris Hip Score (Modified).

The results showed excellent results in 20 (67%) diseased hips, good in 06 (20%) hips, fair in 3 (13%) hips. No poor outcome was noted in the study.

Table 6: Harris Hip Score (Modified)

RESULTS	**NO. OF HIPS**	**DISTRIBUTION**
EXCELLENT	20	67%
GOOD	6	20%
FAIR	4	13%
POOR	0	0%

Graph-6



GRAPH SHOWING MODIFIED HARRIS HIP SCORE

Statistical Significance:

The study was evaluated using Wilcoxon Matched Pairs Signed Test.

Table 7

Mean +/- SD of HHS Pre-Op	Mean +/- SD of HHS Pre-Op	Statistical Test
42.566 +/- 11.153	88.566 +/- 7.323	Wilcoxon Matched Pairs Signed Test P< 0.0001 HS

CLINICAL AND RADIOLOGICAL PHOTOGRAPHS

Case 1

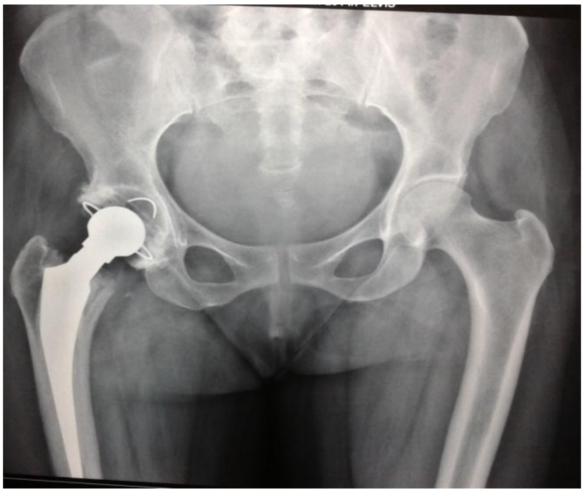
Secondary OA Right Hip

Pre-Op Xray

Immediate Post Op

3 Months follow up

6 Months follow up



Clinical Photograph of same patient with functions:

Operative Scar

Hip Extension

Hip Flexion

Hip Adduction

Hip Abduction

Weight Bearing

Case 2

Septic Arthritis Of Hip In Adult Treated With Two-Stage Surgery

Pre-Op Xray

Post Resection with Antibiotic Bead In Situ

Immediate After Conversion to THR

3 Months Post Op

At latest Follow-up

Clinical Photograph of same patient with functions:

Operative Scar

Hip Extension

Hip Flexion

Hip Adduction

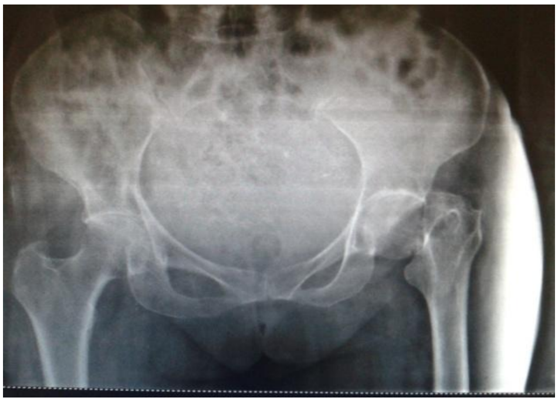
Hip Abduction

Weight Bearing

Case 3

Non Union Fracture Neck Femur

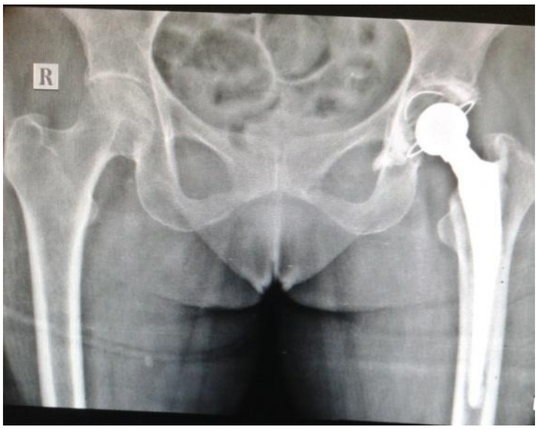
Pre-Op Xray



Immediate Post Op

3 Months follow-up

6 Months follow-up



Clinical Photograph of same patient with functions:

Operative Scar

Hip Extension

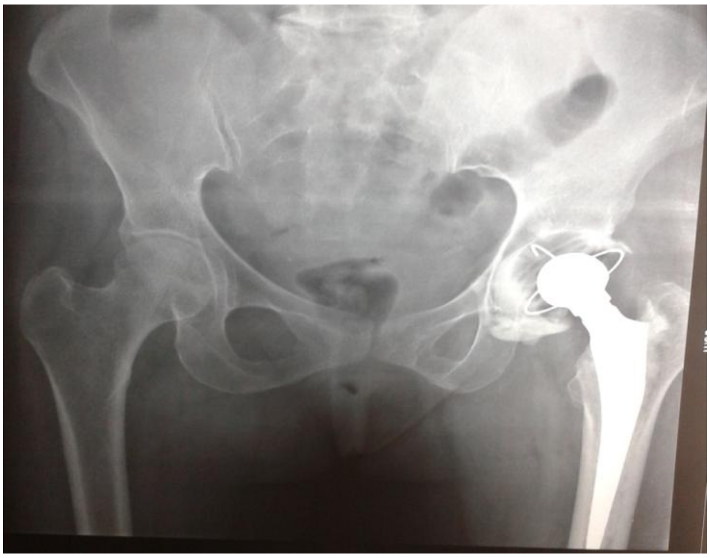
Hip Flexion

Hip Adduction

Weight Bearing

Dislocated Prosthetic Hip

Post reduction Xray



DISCUSSION

Total hip replacement has in the past four decades has revolutionized the treatment of arthritic hip and is a permanent method of relieving pain in the hip due to various conditions. The aim of the surgery includes relieving pain and to preserve motion and stability of the joint.

Cemented total hip replacement is a well documented procedure and has been proved to have a survival rate upto 20 years or more during which the patient has had trouble free activity.

It has some limitations like the long term complications Associated with the cementing technique mainly aseptic loosening and difficult revision surgeries.

The methods used in our study compared with most of the commonly employed methods at replacement the world over had not much difference. The posterior approach has gradually achieved worldwide fame, adequate exposure and practically and theoretically equal chances of post operative dislocation. In our study all cases were operated with posterior approach.

The strength of this study is that all hips were primary replacements, all were done using a uniform technique, done at the same hospital and no patient lost for follow – up. The limitation of this study is follow up duration which is relatively short to demonstrate the long term complications that are bound to occur.

Complications

In our study, we had 2 cases (7%) of posterior dislocations noted. One case got dislocated on the 5th post – operative day while the patient was trying to squat against advice given to her and the other occurred 8 months after the replacement, patient had road traffic accident following which patients prosthetic hip got dislocated. Both the dislocations were reduced and post reduction skin traction in one patient and skeletal traction for another patient with abduction of legs for both patients. Amstutz[80] et al. in their study have reported a 3% incidence of dislocation of hip in first week.

In our study, 1 of the 2 cases (5%) had dislocation in the 1st week. Alberton[64] et al. reported a 7.4% dislocation rate in a group of 1548 revision total hip procedures with at least 2-year follow-up. The incidence of dislocation in this study is comparable to the rate of dislocation (7.4%) noted in the study conducted by Alberton[91] et al.

LIMB LENGTH DISCREPANCY

In our study it was found 2 patients having a lengthening of 1.5cm and one patient having 2cm.

In our study 3 patients had lengthening of = >1.5 cm, 2 of them had excellent outcome and 1 had fair results.

In a survey of 1114 primary total hip arthroplasty patients, 30% reported a perceived limb-length discrepancy. Of these, only 36% had a radiographically confirmed discrepancy. The functional significance of leg-length inequality after total hip arthroplasty has not yet been well defined[64].

Nerve injury

In our study it was found that in one patient there was sciatic nerve neuropraxia, patient was advised passive dorsiflexion and plantarflexion exercises in the immediate post op and was given below knee prosthesis to prevent equines deformity. Patients recovered from the neuropraxia in 6 weeks. Weight bearing was delayed. Silbey and Callaghan described one patient with postoperative sciatic nerve palsy that resolved with early exchange of a modular head to one with a shorter neck length[64].

Sakai[92] et al. similarly noted complete resolution of postoperative sciatic nerve palsy after shortening of the calcar and modular femoral neck.

Comparison of Results

In this study, we have noted excellent outcome in 20 operated hips (67%), good in 6 hips (20%) and fair results in 4 hips (13%). No poor results were noted. Hence, excellent or good results were noted in 26 hips (87%) whereas fair or poor results were noted in 4 hips (13%).

The outcome noted in this series is comparable to other studies which had a long follow up period.

Table 8

STUDY	YEAR	RESULT
Kavanagh[93]	1989	excellent or good results were noted in 78% of the hips
Schulte [94]	1993	86% excellent or good results and 14% fair or poor
R C Siwach[58]	2007	75% good results were noted.
Rajendra Nath[59]	2010	80% excellent to good results.
Our study	2014	67% - excellent, 20% good, 13% -fair

Although long term follow up is required in our study for assessment of late complications. The excellent results in this series and also in other studies suggest that early complete abandonment of the cemented implant may have been be premature.

STATISTICAL SIGNIFICANCE:

There was a statistically significant improvement ('p' value of <0.0001) in the post operative score when compared to pre operative score.

CONCLUSION

Our experience and results conclude that primary cemented total hip replacement still holds its place in the India and is a excellent procedure in the management of arthritic hip especially in the elderly with abrupt change in the restricted lifestyle post surgery.

Low socio-economic class of people can afford the cemented implants and the longevity of the cemented replacement is not really in doubt as proved by Sir John Charnley in his follow up of cemented THR done 22 years ago.

The assessment of clinical results of cemented total hip replacement has shown that there is definitive improvement with regard to pain, function and range of motion post-operatively.

We are slowly entering into generation where we have to 'REVISE THE REVISION' which would pose the greatest of all the challenges to the institution of hip replacement.But its certain that research in this field would yield benefits to this wonderous surgery.

LIMITATIONS OF THIS STUDY –

It's a short term study and long term results are necessary to know the late complications and the overall functional and clinical outcome.

SUMMARY

Total hip replacement arthroplasty is a surgical procedure done mainly to relieve incapacitating pain arising from the hip joint and its success lies in its ability to relieve this pain associated with hip joint pathology, while maintaining the mobility and stability of the hip joint.

This was a prospective study, carried out on 30 patients who underwent cemented Total Hip Replacement and were available for follow-up. Though while our study was limited to 30 T.H.A., Berger et al performed 150 T.H.A., Harris et al performed 126 T.H.A. and Goldberg et al performed 125T.H.A. This is due to the fact that this study was limited to a very short duration. Also, financial constraints and unawareness of this procedure to the patient limited the number of patients for this study.

This study was conducted on patients with age ranging from 36 to 75 years with a mean age of 56.9 years. Maximum numbers of patients, 14 in number, were in age group of 56-65years of age (47%) and 20 patients (67%) were males. Right side was affected in 16 patients (58%), left side was affected in 14 patients (42%).

Secondary osteoarthritis of the hip was the commonest indication for the surgery, the number being 15 (50%) out of the 30 patients operated. The causes of osteoarthritis were various. Other indications of the surgery were neglected dislocation of hip, rheumatoid arthritis and non union fracture neck of femur. The number of patients for these 3 indications was 1(3%), 5 (10%) and 11 (37%) respectively.

A thorough clinical and radiological examination was performed. All the patients were prepared and operated once the general condition was stable and the patient was fit for surgery.

All the patients were operated through posterior approach, putting patient in lateral position and were treated with Modular system. All the patients were advised to do isometric quadriceps exercise from 2nd postoperative day. Patients were made to sit up on 3rd post-operative day and advised knee bending exercises. Patients were made to stand up and walk on 5th postoperative day Sutures were removed on 12th postoperative day and discharged on 12th day with the advice not to adduct and internally rotate the limb and also not to squat and sit crossed leg. Patients were asked to come for follow up on 6weeks, 3 months and 6 months.

The minimum patient follow up for the study was 6 Months. With regards to the different parameters in the scoring system ie, pain, gait, functional activity and ROM, there was a statistically significant improvement ('p' value of <0.0001) in the post operative score when compared to pre operative score.

Pre operatively 90.5% had a poor score. The results showed a significant improvement, wherein 67% had an excellent score and 20% showed good and 4% fair results each. No patient had a poor score.

2 cases of dislocation (07%) were noted, one on the 5th post-operative day and the other occurred 8months after the patient was discharged from the institution. Both were reduced in the Emergency closed reduction and traction for 3 weeks.

1 case of sciatic nerve palsy was noted, patient recovered from the neuropraxia in 6 weeks. All the patients were followed up regularly; no patients were lost for follow up. They were evaluated according to the Modified Harris Hip Scoring system.

Early complete abandonment of the cemented implant may have been be premature as results have shown over the years of equal rates of revision surgeries in uncemented implants.

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ANNEXURE-I

Institutional Ethical Committee
BIJAPUR-586 103.
OUTWARD
No. 046/12
Date 18/10/12
B.L.D.E.U's Shri B.M. Patil Medical College

B.L.D.E. UNIVERSITY'S

SHRI.B.M.PATIL MEDICAL COLLEGE, BIJAPUR-586 103

INSTITUTIONAL ETHICAL COMMITTEE

INSTITUTIONAL ETHICAL CLEARANCE CERTIFICATE

The Ethical Committee of this college met on 18-10-2012 *at* 3-30pm *to scrutinize the Synopsis of Postgraduate Students of this college from Ethical Clearance point of view. After scrutiny the following original/corrected & revised version synopsis of the Thesis has been accorded Ethical Clearance.*

Title "Evaluation of Short term functional outcome of primary cemented total hip replacement in adult - A two year prospective study"

Name of P.G. student Dr. Mithun N Oswal

Orthopaedics

Name of Guide/Co-investigator Dr Kiran. S. Patil

prof of Orthopaedics

DR.TEJASWINI. VALLABHA
CHAIRMAN
INSTITUTIONAL ETHICAL COMMITTEE
BLDEU'S, SHRI.B.M.PATIL
MEDICAL COLLEGE, BIJAPUR.

Following documents were placed before E.C. for Scrutinization

1) Copy of Synopsis/Research project.
2) Copy of informed consent form
3) Any other relevant documents.

ANNEXURE-II

SHRI B.M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE, BIJAPUR – 586103.

CONSENT FORM

TITLE OF RESEARCH: EVALUATION OF SHORT TERM FUNCTIONAL OUTCOME OF PRIMARY CEMENTED TOTAL HIP REPLACEMENT IN ADULTS. A TWO YEAR PROSOECTIVE STUDY.

Principle Investigator	:	DR. MITHUN N OSWAL
P.G. Guide Name	:	DR. KIRAN S PATIL M.S (ORTHO)

All aspects of this consent form are explained to the patient in the language understood by him/her.

I) INFORMED PART

i. Purpose of study

I have been informed that this study will test the effectiveness of TOTAL HIP REPLACEMENT. This method requires hospitalization.

ii. Procedure

I will be selected for the treatment after the clinical study of my age, hip condition, condition of bone seen in radiograph and after study of fitness for anaesthesia and surgery. I will be admitted electively. I will have to attend follow-up to OPD regularly. I will be assessed in physiotherapy department also.

iii. Risk and Discomfort

I understand that I may experience some pain and discomfort during the post operative period. This condition is usually expected. These are associated with the usual course of treatment

iv. Benefits

I understand that my participation in this study will have no direct benefit to me other than the potential benefit of treatment which is planned to relieve my pain in the shortest possible period and restore my hip function.

v. Alternatives

I understand that, the various alternative modes of treatment available to me for this condition with their merits and demerits have been explained to me.

vi. Confidentiality

I have been assured that all information furnished to the doctor by me regarding my medical condition will be kept confidential at all times and all circumstances except legal matters.

vii. Request for more information

I understand that I may ask more questions about the study at anytime. Dr.Mithun is available to answer my questions or concerns. I understand that I will be informed of any significant new findings discovered during the course of the study, which might influence my continued participation.

If during the study, or later, I wish to discuss my participation in or concerns regarding this study with a person not directly involved, I am aware that the social worker of the hospital is available to talk with me.

viii. Refusal or withdrawal of participation

It has been made clear to me that participation in this medical research is solely the matter of my will and also that right to withdraw from participation in due course research at any time.

II) CONSENT BY PATIENT

I undersigned, have been explained by Dr Kiran S Patil in the language understood by me. The purpose of research, the details or procedure that will be implemented on me. The possible risks and discomforts of surgery and anaesthesia have been understood by me. I have also been explained that participation in this medical research is solely the matter of my will and also that I have the right to withdraw from this participation at any time in due course of the medical research.

Signature of participant/patient date: time:

Signature of witness: date: time:

ANNEXURE – III

SCHEME OF CASE TAKING:

Name:	I P No:
Age/Sex:	DOA:
Occupation:	DOS:
Residence:	DOD:

Presenting complaints with duration:

History of presenting complaints:

Family History:

Personal History:

Past History:

General Physical Examination

Pallor: present/absent

Icterus: present/absent

Clubbing: present/absent

Generalized Lymphadenopathy: present/absent

Build: Poor/Moderate /Well

Nourishment: Poor / Moderate / Well

Vitals

PR: RR:

BP: TEMP:

Other Systemic Examination:

- Respiratory System
- Cardiovascular System
- Central Nervous System
- Per Abdomen

Local examination

Gait:

Inspection:

- Attitude
- Anterior Superior Iliac Spine – same level/ raised/ lowered
- Lumbar lordosis
- Shortening and Deformity
- Swelling

- Skin
- Muscle Wasting
- Wounds, if any
- Other fractures ,if any

Palpation:

- Tenderness
- Local rise of temperature – yes / no
- Broadening/ migration of greater trochanter – yes/ no
- Crepitus – yes / no
- Swelling

Movements :

		Active	Passive
Hip :	Flexion		
	Extension		
	Internal rotation		
	External rotation		
	Adduction		
	Abduction		
Knee :	Flexion		
	Extension		

Measurements : Apparent length : Xiphisternum to Medial malleolus

True length : Anterior superior iliac spine to Medial malleolus

Anterior superior iliac spine to Medial Joint Line of Knee Joint

Medial joint line of knee joint to medial malleolus

Girth of the Limb.

Bryant's triangle

Nelaton's line

Shoemaker's line

Stability test : Telescopic Test

Tredlenburg's test

Thomas test

Abnormal Mobility

Transmitted movements

INVESTIGATION:

Blood: | Urine:

Blood	Urine
Hb%	Microscopy
TC	Sugar
DC	Albumin
ESR	
BT	
CT	
PT/INR	
CRP	
BLOOD UREA	
SERUM CREATININE	
RBS	

X-Ray : Chest PA view

Bilateral hip with proximal femur – AP view

Lateral view of affected Hip

ECG:

Final Diagnosis:

Details of Surgery:

- Stability on operating table
- Intraoperative complications ,if any
- Blood Loss

Post operative Management:

- Mobilization:
- Wound healing and suture removal
- Complications:

Date of Discharge:

Condition at discharge:

- Clinical:
  - Shortening if any
  - Complications if any
  - Deformity
    - Flexion
    - Adduction/Abduction
    - Rotational
  - Range of movements:

	Active	Passive
Flexion		
Adduction		
Abduction		
Internal rotation		
External rotation		

Follow up

Clinical

- Patient complaints
  1. Pain
  2. Limp.
  3. Gait.
  4. Activities.
  5. Any other.
- Deformity -
- Movements Active Passive

  1.Flexion

  2.Adduction

  3.Abduction

  4.Rotation

- Quadriceps

  1.Wasting

  2.Power

- Tredlenburg's test
- Shortening

Key to Master chart

Exc : Excellent

HHS : Harris hip score (modified)

HTN : Hypertension

NFN Non union fracture neck of femur

OA : Secondary osteoarthritis of hip

S.I.NO: Serial Number

I.p no: In patient number

Preop : preoperative

Postop: postoperative

MASTER CHART

Sr. no.	Name	Age (yrs)	Sex	I.p no	Occupation	Diagnosis	Side	AD	Preop HHS	Pre Rate	Post Op HHS	Post Rate	Complications	Implant	Stem
1	Ningawwa Biradar	45	Female	20218	Housewife	NFN	Left	Nil	47	Poor	94	Exc	Nil	Modular	Muller
2	Sayabanna Singade	53	Male	20310	Driver	OA	Right	Nil	13	Poor	82	Good	Nil	Modular	Muller
3	Mallikarjun Kotatnur	48	Male	22468	Farmer	OA	Left	Nil	49	Poor	91	Exc	Nil	Modular	Muller
4	Gangawwa Yargatti	64	Female	25440	Housewife	OA	Right	Diabetes	32	Poor	92	Exc	Nil	Modular	Muller
5	Vinod Gorali	37	Male	25263	Farmer	NEG DISLO	Left	Nil	67	Poor	94	Exc	Dislocation	Modular	Muller
6	Ballappa Bagali	56	Male	29012	Farmer	NFN	Right	Nil	45	Poor	96	Exc	Nil	Modular	Muller
7	Hannappa Patil	65	Male	29887	Retired	OA	Right	Nil	49	Poor	84	Good	Nil	Modular	Muller
8	Shantabai Tenahalli	60	Female	25749	Housewife	NFN	Left	Nil	54	Poor	90	Exc	Dislocation	Modular	Muller
9	Saleem Choudari	57	Male	29494	Farmer	OA	Right	Nil	46	Poor	91	Exc	Nil	Modular	Muller
10	Mallawwa Tumbagi	60	Female	191	Housewife	NFN	Left	Nil	36	Poor	71	Fair	Nil	Modular	Muller
11	Umabai Jadhav	49	Female	330	Housewife	OA	Left	Nil	64	Poor	94	Exc	Nil	Modular	Muller
12	Kallappa	75	Male	30190	Farmer	OA	Right	Nil	44	Poor	92	Exc	Nil	Modular	Muller
13	Siddarai Dyaberi	65	Male	2860	Retired	OA	Left	Nil	38	Poor	93	Exc	Nil	Modular	Muller
14	Saraswati	70	Female	3426	Housewife	OA	Right	Nil	15	Poor	87	Good	Nil	Modular	Muller
15	Suresh Kolaker	59	Male	3546	Farmer	NFN	Left	HTN	47	Poor	95	Exc	Nil	Modular	Muller
16	Hanamant Bhujad	48	Male	4776	Farmer	NFN	Right	Nil	28	Poor	91	Exc	Nil	Modular	Muller

17	Mallappa Hiremath	63	Male	6193	Farmer	OA	Right	Nil	45	poor	86	Good	Nil	Modular	Muller
18	Sumitrabai Sonnad	53	Female	6679	Labourer	OA	Right	Nil	39	Poor	85	Good	Nil	Modular	Muller
19	Vidya Toravi	58	Female	7741	Labourer	RA	Left	Diabetes	48	Poor	92	Exc	Nil	Modular	Muller
20	Hemant K	61	Male	7787	Farmer	OA	Right	Nil	42	Poor	96	Exc	Nil	Modular	Muller
21	Sanyawwa Daigond	56	Female	10037	Housewife	NFN	Left	Nil	47	Poor	71	Fair	Nil	Modular	Muller
22	Sampath Kalekar	45	Male	11680	Farmer	RA	Left	Nil	49	Poor	92	Exc	Nil	Modular	Muller
23	Devander Walikar	54	Male	12324	Farmer	NFN	Right	HTN	41	Poor	72	Fair	Nil	Modular	Muller
24	Saibgouda Biradar	70	Male	13254	Farmer	OA	Right	HTN	35	Poor	91	Exc	Neuropraxia	Modular	Muller
25	Raju K B	58	Male	17090	Labourer	NFN	Right	Nil	43	Poor	96	Exc	Nil	Modular	Muller
26	Sanganagouda	57	Male	11229	Farmer	NFN	Left	HTN	41	Poor	77	Good	Nil	Modular	Muller
27	Lakshman Rangappa	66	Male	16852	Farmer	OA	Left	Nil	48	Poor	93	Exc	Nil	Modular	Muller
28	Kasturibai Bajantri	48	Female	6490	Farmer	OA	Right	Nil	46	Poor	92	Exc	Nil	Modular	Muller
29	Mahadev Madar	59	Male	30309	Labourer	NFN	Right	Nil	36	Poor	85	Good	Nil	Modular	Muller
30	Siddappa Biradar	48	Male	11741	Clerk	RA	Left	Nil	43	Poor	92	Good	Nil	Modular	Muller